REGISTER

OF

THE LEHIGH UNIVERSITY,

SOUTH BETHLEHEM, PA.

1898-1899.

FOUNDED BY ASA PACKER.

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BETHLEHEM, PA.:
TIMES PUBLISHING COMPANY.
1899.

TABULAR ALMANAC.

1898.

JULY.

S	M	T	W	T	F	S
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AUGUST.

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SEPTEMBER.

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1899.

JANUARY.

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MARCH.

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APRIL.

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JUNE.

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CALENDAR.

1898.	1898-1899.
Sept. 17, 19, 20,	Examinations for Admission.
Sept. 21,	First Term begins.
Oct. 13,	Founder's Day.
Nov. 24,	Thanksgiving Day.
Dec. 22, 12½ P.M.	Christmas Holidays begin.
1899.	
Jan. 3, 8¼ A.M.,	Christmas Holidays end.
Jan. 14,	Junior Prize Orations due.
Feb. 1,	First Term ends.
Feb. 2, 8¼ A.M.,	Second Term begins.
Feb. 22,	Washington's Birthday.
March 29, 12½ P.M.,	Easter Holidays begin.
April 5, 8¼ A.M.,	Easter Holidays end.
May 20,	University Day Orations due.
May 24,	Senior Examinations begin.
May 30,	Memorial Day (half holiday).
June 5,	Annual Examinations begin.
June 7,	Graduation Theses due.
June 11,	Baccalaureate Sunday.
June 12,	Class Day.
June 13,	Alumni Day.
June 14,	University Day.
June 15—July 8,	Summer School of Surveying.
June 15, 16, 17,	Examinations for Admission.

1899.	1899-1900.
Sept. 23, 25, 26,	Examinations for Admission.
Sept. 27,	First Term begins.
Oct. 12,	Founder's Day.
Dec. 22, 12½ P.M.,	Christmas Holidays begin.
1900.	
Jan. 3, 8¼ A.M.,	Christmas Holidays end.
Feb. 5,	Second Term begins.
June 20,	University Day.

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Chatham, Ont.

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Absent on leave.

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215 Wall Street, Bethlehem.

JOHN C. PECK, Ph.B.,
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616 Chestnut Street, South Bethlehem.

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138 Church Street, Bethlehem.

Organist,
J. FRED WOLLE.
148 Church Street, Bethlehem.

GYMNASIUM.

Instructor,
C. W. SMITH.

LIBRARY.

Director,
WILLIAM H. CHANDLER, Ph.D.

Cataloguer,
A. W. STERNER.

Shelf Clerk,
PETER F. STAUFFER.

THE LEHIGH UNIVERSITY.

ORIGIN.

The HON. ASA PACKER, of Mauch Chunk, during the year 1865, appropriated the sum of $500,000, to which he added one hundred and fifteen acres of land in South Bethlehem, to establish an educational institution in the rich and beautiful Valley of the Lehigh. On this foundation rose THE LEHIGH UNIVERSITY, incorporated by the Legislature of Pennsylvania in 1866. In addition to these gifts, made during his lifetime, Judge Packer by his last will secured to the University an endowment of $1,500,000, and to the University Library one of $500,000.

DESIGN.

The original object of Judge Packer was to afford the young men of the Lehigh Valley a complete education, technical, literary, and scientific, for those professions represented in the development of the peculiar resources of the surrounding region. In furtherance of this purpose instruction is liberally provided in Civil, Mechanical, Mining, and Electrical Engineering, Metallurgy, Chemistry, and in all needful collateral studies. A School of General Literature is also established and thoroughly equipped, and includes the Classical course, the Latin-Scientific course, and the course in Science and Letters.

TUITION.

The following charges are made for tuition:

For students in the Technical courses, $100 for the entire year, or $60 for either term; for students in the school of General Literature, $60 for the entire year, or $40 for either term. A student who has withdrawn more than one month before the end of either term may make application for the return of a part of the tuition fee; but the amount thus refunded will in no case exceed one half of the last instalment paid to the Treasurer.

These fees include all tuition, with the use of the Library and Gymnasium, but the student is charged for materials and apparatus consumed in the Laboratories.

A limited number of scholarships, covering the cost of tuition, is available for applicants of good moral character who shall pass the entrance examinations creditably, and who for other cause shall be regarded as worthy by the Faculty.

Application for these free scholarships should be made to the President of the University, who will furnish all needed information concerning the regulations which govern their bestowal.

All fees for tuition are payable to the Treasurer of the University in two instalments. The first instalment, of $60, is to be paid to the treasurer of the University on or before October 10; the second, of $40, on or before February 10. For students in the school of General Literature, the instalments are $40 and $20, respectively.

Students who fail to pay tuition fees when due will be notified that their attendance at college exercises must be discontinued until payment is made.

Every candidate for a degree is required to pay a graduation fee of $10, before the degree is conferred.

PUBLIC WORSHIP.

Prayers are held in the Packer Memorial Church of the University every morning, at which attendance is required.

Divine service is held every Sunday morning in the church. Any student who may desire to attend some other place of worship will be permitted to do so upon the request of his parent or guardian or, if he be 21 years of age, upon his own request. The request for such permission should be renewed at the beginning of each year.

Attendance, either at the Packer Memorial Church or at the church of his selection, is required of every student.

SITE.

The situation of the institution is healthful and beautiful. The region is famous for its railway and manufacturing enterprises; it possesses some of the richest iron and coal mines in our land, and thus gives the students rare facilities for confirming the teachings of the recitation room by the observation of the eye.

South Bethlehem is situated at the junction of the Lehigh Valley, the New Jersey Central, and the Reading (North Pennsylvania) Railroads, and the University buildings are about a half-mile from the station. New York is eighty-seven and Philadelphia fifty-eight miles distant.

BUILDINGS.

PACKER HALL.

This building, completed in 1869, is four stories in height, 215 feet long, and mostly 60 feet in width. It is built of Potsdam sandstone in the English Gothic style of architecture, and occupies a commanding position, overlooking Bethlehem, West Bethlehem, and South Bethlehem. It contains the lecture and recitation rooms of the departments of Greek, Latin, Modern Languages, History, and Mathematics.

The department of Civil Engineering has, on the first floor, two drawing rooms and three lecture rooms, together with instrument rooms and offices. Here are found collections of bridge models, photographs and blue-prints, specimens of building materials, and also a large number of levels, transits, and other surveying instruments. The testing laboratory in the basement has three machines for tests of tension, compression, flexure, and torsion; a 2000-pound cement machine, and smaller apparatus for special experiments on beams and columns. The cement laboratory has recently been enlarged and its equipment made very complete. The Freshman drawing room of the Civil Engineering department is located on the fourth floor.

The second floor of this building is devoted to the class room and drafting work of the department of Mechanical Engineering. Here are the various recitation rooms, and the well lighted and equipped drafting rooms for the several classes. Near these are the offices of the professor and instructors, the blue-print room, and the reference library of the department, with its large store of prints and working drawings. A wide range of machinery is illustrated by cuts and photographs on the walls. The drafting rooms are further equipped with an extensive assortment of machine parts in cases, with a full-sized link-motion constructed for Lehigh Valley Railroad practice, and with a small eight-wheel locomotive, which is an exact reproduction on a scale of one-sixth of a standard passenger locomotive, and which is noticeable for its exact workmanship and delicate finish.

On the third and fourth floors are to be found the lecture and drawing rooms of the department of Mining Engineering and Geology, the museum of geology and natural history, and other class rooms.

THE CHEMICAL LABORATORY.

This is a thoroughly fire-proof building, built of sandstone, and 219 feet in length by 44 in width.

There are two principal stories and a basement. The upper floor is occupied by the quantitative and the qualitative chemical laboratories, the former accommodating 48 and the latter 84 students. These rooms are 22 feet in height, and are well lighted and ventilated. A laboratory for industrial chemistry and the supply room are also on this floor.

The first floor contains a large lecture room, a recitation room, a chemical museum, and laboratories for organic, physiological, agricultural, and sanitary chemistry.

In the basement is the large laboratory for the furnace assay of ores and a well appointed laboratory for gas analysis, also rooms containing the apparatus for several processes in industrial chemistry, the engine and air-pump for vacuum filtration, a store room, and the toilet.

A photographic laboratory is located in the third story of the central portion of the building.

THE METALLURGICAL LABORATORY

contains a lecture room, a blowpipe laboratory for class instruction in blowpipe analysis and in the practical determination of crystals and minerals, a museum for mineralogical and metallurgical collections, a mineralogical laboratory provided with a Fuess reflecting goniometer, a polariscope, a Groth's "universal apparat," and a Rosenbusch polarizing microscope, a dry laboratory provided with furnaces for solid fuel and for gas with natural draught and with blast, and a wet laboratory for ordinary analytical work. It is arranged for the instruction of classes in the courses of mineralogy, metallurgy, and blowpipe analysis of the regular curriculum, and to afford facilities to a limited number of advanced students for familiarizing themselves with the methods of measurement and research employed in mineralogy and metallurgy, and for conducting original investigations in these departments of science.

THE PHYSICAL LABORATORY.

This is a stone building, 235 feet long, 44 feet wide, and four stories high. On the first floor are the dynamo laboratory, the workshop, the battery room, and research rooms for thesis work. The dynamo laboratory is provided with a 50 horse-power steam engine and is well equipped with electrical machinery and measuring instruments. In the workshop a 6 horse-power electric motor drives three lathes, a drill-press, an emery grinder, and a buzz-saw; and an 80-cell storage battery is installed in the battery room.

On the second floor are the designing-room, the beginnings of an electro-technical museum, the electrical laboratories, and a department library and reading room.

On the third floor are the physical lecture room, with apparatus rooms adjoining, a large audience hall, and recitation rooms; and on the fourth floor are the laboratories for general physics, light, and photography, and two recitation rooms.

SAUCON HALL.

Extensive alterations to this building were made in 1896, adapting it to the needs of the departments of English and of History and Economics. It is well warmed and lighted, and contains a study and a recitation room for each instructor, a hall for lectures seating 150 persons, a large room on the ground floor which has been fitted up for the use of the Debating Societies, with committee rooms adjoining, and the offices of the Brown and White. A set of rooms on the second floor has been set aside for the use of the Alumni, where they now have a comfortable office, a committee room, and a safe and commodious place for storing their archives. It is proposed to make further improvements in the building in the near future.

THE SAYRE OBSERVATORY.

Near Brodhead Avenue is the Sayre Observatory, the gift of Robert H. Sayre, Esq., of South Bethlehem, containing an equatorial and a zenith telescope, transit instrument, and astronomical clock.

THE PACKER MEMORIAL CHURCH

is the munificent gift of Mrs. Mary Packer Cummings, daughter of the Founder of the University. It is one of the largest and most magnificent churches in the State, richly furnished and handsomely appointed in every particular.

THE UNIVERSITY LIBRARY.

To the east of Packer Hall is the University Library, erected by the Founder in memory of Mrs. Lucy Packer Linderman, his daughter.

THE GYMNASIUM

is a handsome and spacious structure, built and equipped with the utmost thoroughness. It is furnished with the best patterns of gymnastic apparatus, besides Dr. Sargent's system of developing appliances. It is provided with hot and cold water; tub, sponge, and shower baths, and 389 clothes closets. Opportunities for recreation and amusement are provided in the bowling alleys. It is under the immediate care of a skilled and competent Instructor.

All students are required to undergo a physical examination before being allowed the use of the Gymnasium, and this examination will be repeated once each year during their stay at the University. The proper exercise is prescribed and is required of every student. These regulations are designed to promote the harmonious, symmetrical development of the individual student.

EXPENSES.

Books, materials, paper, pencils, materials used in the laboratories, and drawing instruments are furnished by the student. Materials consumed in the laboratories can be obtained from the University, their value being covered by a deposit made at the opening of that term in which the laboratory work is to be done.

Rooms and board cannot be had in University buildings, but can readily be obtained in many private houses.

The following is an estimate of the necessary expenses for the collegiate year, clothing and traveling not included:

Tuition,	$100	$100
Board for 36 weeks,	from 126 to	180
Room-rent, with fuel and lights	40 "	80
Care of room and use of furniture,	5 "	20
Washing and incidentals,	20 "	40
Books, stationery, etc.,	25 "	50
Total,	$316 to	$470

(In the case of students in the School of General Literature, the charge for Tuition is $60, and the totals are $276 to $430.)

ADMISSION OF STUDENTS.

The Register is intended to give all necessary information concerning the admission of students. Application may be made to the Secretary of the Faculty if information is desired which is not given in the Register.

DATE OF EXAMINATIONS.

Examinations for admission to the University will be held in 1899 on Thursday, Friday, and Saturday, June 15, 16, and 17, and on Saturday, Monday, and Tuesday, September 23, 25 and 26. All applicants *must* be in attendance at 8.30 o'clock on the morning of the first day.

The examinations are held in June and September in the following order:

First Day.—English, 8.30 A.M.; Physics, 2 P.M.; Latin and Roman History, 2 P.M.

Second Day.—Geometry, 8.30 A.M.; United States History, 2 P.M.

Third Day. — Algebra, 8.30 A.M.; German or French, 2 P.M.; Greek and Greek History, 2 P.M.

Examinations are also held for admission to the Freshman Class at the beginning of the second term and for admission to the Sophomore Class at the beginning of the first term; information as to these examinations may be obtained from the Secretary of the Faculty. Examinations at other than the appointed times can not be granted without great inconvenience, and candidates so applying will be required to pay a fee of $5 into the Faculty's fund for the aid of indigent students.

CHARACTER OF THE EXAMINATIONS.

The examinations are rigorous and cover the entire ground laid down in the following scheme. They are all conducted in writing, supplemented by an oral examination at the option of the examiner.

Each candidate for admission must be at least sixteen years of age, and must present a testimonial of good moral character from his last instructor, or from the school or institute to which he last belonged, or from some reputable citizen of the community in which he lives.

Candidates for admission to

THE CLASSICAL COURSE

are examined in the following subjects:

1. *English.* — This requirement includes: (*a*) English Grammar, especial attention being given to the analysis and correction of sentences; and (*b*) Rhetoric and Composition. Any High School Rhetoric, such as those of Hart, Hill, Williams, Kellogg, and others of a like grade, will be sufficient, together with practical exercises in composition.

Greater stress will be laid, year by year, upon accurate and idiomatic use of the vernacular, upon correct pronunciation, clearness and facility in expression and in the presentation of ideas, an acceptable style in writing — in short, upon all that may fairly be expected of the student as the result of a thorough and intelligent preparation in English. To gain this end, it may be well to use the list of books suggested by the Joint Committee of Colleges and Preparatory Schools for admission to the colleges of the Middle States. These are, for 1899:

Pope's translation of the Iliad, Books I, VI, XXII, XXIV; the Sir Roger de Coverly Papers in The Spectator; Goldsmith's Vicar of Wakefield; Coleridge's Ancient Mariner; De Quincey's Flight of a Tartar Tribe; Dryden's Palamon and Arcite; Lowell's Vision of Sir Launfal; Hawthorne's House of the Seven Gables; Cooper's Last of the Mohicans; Shakespeare's Macbeth; Milton's Paradise Lost, Books I, II; Burke's Speech on Conciliation with America; Carlyle's Essay on Burns.

From one of the last four books in the list a theme will be taken for the composition which forms a part of the examination paper.

The student is also urged to the fullest possible use of all the opportunities for vocal culture which his means of preparation afford.

Attention is called to the fact that the right is reserved to regard hereafter all examination papers, upon whatever subject, as part of the English examination.

The books suggested for 1900 are as follows .

Dryden's Palamon and Arcite; Pope's translation of the Iliad, Books I, VI, XXII, XXIV; the Sir Roger de Coverly Papers in The Spectator; Goldsmith's Vicar of Wakefield; Scott's Ivanhoe; De Quincey's Flight of a Tartar Tribe; Cooper's Last of the Mohicans; Tennyson's Princess; Lowell's Vision of Sir Launfal; Shakespeare's Macbeth; Milton's Paradise Lost, Books I, II; Burke's Speech on Conciliation with America; Macaulay's Essays on Milton and Addison.

2. *American History*, with the elements of civic government.

[Montgomery's Leading Facts of American History and Fiske's Civil Government may serve to indicate the amount and character of this requirement. Geographical knowledge, to be tested by a reference to an outline map, will form part of this examination.]

3. *Algebra.*—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities. Equations of the first and second degrees. Ratio. Proportion and progressions.

4. *Geometry.*—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures. Regular polygons. Measurement of the circle. Maxima and minima of plane figures, and plane and polyhedral angles.

Candidates must have a knowledge of the metric system and be prepared to solve problems in either Algebra or Geometry involving the use of metrical units.

5. *Latin Grammar.*

6. *Cæsar*, four books of the Gallic war.

7. *Cicero*, six orations, including the four against Catiline.

8. *Vergil*, the first six books of the Æneid, including Prosody.

9. The translation, at sight, of passages from Cæsar and Cicero.

10. The translation of English into Latin. (As special importance is given this part of the examination, it is suggested to teachers that they connect exercises in making Latin, both oral and written, with all the studies of the preparatory course.)

11. *Roman History.*—Creighton, Pennell, or Myers.

12. *Greek Grammar.*

13. *Xenophon*, Anabasis, four books.

14. *Homer*, Iliad, first three books, including Prosody. The Catalogue of Ships may be omitted.

15. The translation, at sight, of a passage from some work of Xenophon.

16. *Greek History.*—Fyffe, Pennell, or Myers.

The pronunciation of Greek according to the written accents is followed in the University, and it is desirable that students preparing to enter be taught this system.

Latin is pronounced according to the method generally known as the Roman Method.

Candidates for admission to the Classical Course who have had, in their preparatory schools, no opportunity of studying Greek, will be admitted to that course in full standing upon presenting an amount of French or German equivalent to two years' work. They will begin Greek in the University and study it throughout the course, and will then receive the degree of B.A.

THE LATIN-SCIENTIFIC COURSE.

Candidates for admission to this course must present the first eleven of the above requirements, but substitute for the Greek sections (numbers 12-16 inclusive) the following:

17. *Solid Geometry.*

18. *German.*—This requirement will be satisfied by the completion of an amount equivalent to Part I of Joynes-Meissner's or Calvin Thomas's Grammar, Buchheim's Reader, and additional reading.

[An equivalent amount in French will be accepted in cases in which it is inconvenient for the candidate to offer German. The amount thus required in French is equivalent to Whitney's Practical Grammar and Super's Reader, with additional reading.]

The candidate is expected to have acquired the ability to understand simple German (or French) prose, by the careful reading of about two hundred duodecimo pages, in addition to the study of Grammar. His proficiency will be tested by questions on the rudiments of grammar, by translations of simple English sentences, and by translations at sight of passages of easy German (or French) prose, containing no rare words.

THE COURSE IN SCIENCE AND LETTERS.

Candidates for admission to this course are examined in all the subjects demanded of those entering the Latin-Scientific Course, except the Latin sections (numbers 5-11 inclusive). They also present the following:

19. *Elementary Physics.*—Especial stress is laid upon the candidate's acquaintance with physical phenomena and with the simpler applications of physical laws. The ability to solve advanced or complicated mathematical problems is not required. The character of the examination is indicated by the set of questions given in this Register under the heading "Entrance Examination Papers."

[Nichols's Outlines of Physics, Gage's Elements of Physics, or Avery's Elements of Natural Philosophy (revised edition).]

In 1900 and thereafter the requirements for admission to the Course in Science and Letters will include Plane Trigonometry and Logarithms, through the solution of right and oblique triangles.

[Wells's New Plane and Spherical Trigonometry and Hussey's five-place Mathematical Tables are used in the University and are recommended for preparation, but their use is not obligatory.]

THE SCHOOL OF TECHNOLOGY.

Candidates for admission to the Courses in Civil Engineering, Mechanical Engineering, Mining Engineering, Electrical Engineering, and Chemistry, are examined in the following subjects:

1. *English.*—This requirement includes: (*a*) English Grammar, especial attention being given to the analysis and correction of sentences; and (*b*) Rhetoric and Composition. Any High School Rhetoric, such as those of Hart, Hill, Williams, Kellogg, and others of a like grade, will be sufficient, together with practical exercises in composition.

Greater stress will be laid, year by year, upon accurate and idiomatic use of the vernacular, upon correct pronunciation, clearness and facility in expression and in the presentation of ideas, an acceptable style in writing—in short, upon all that may fairly be expected of the student as the result of a thorough and intelligent preparation in English. To gain this end, it may be well to use the list of books suggested by the Joint Committee of Colleges and Preparatory Schools for admission to the colleges of the Middle States. These are for 1899:

Pope's translation of the Iliad, Books I, VI, XXII, XXIV; the Sir Roger de Coverly Papers in The Spectator; Goldsmith's Vicar of Wakefield; Coleridge's Ancient Mariner; De Quincey's Flight of a Tartar Tribe; Dryden's Palamon and Arcite; Lowell's Vision of Sir Launfal; Hawthorne's House of the Seven Gables; Cooper's Last of the Mohicans;

Shakespeare's Macbeth; Milton's Paradise Lost, Books I and II; Burke's Speech on Conciliation with America; Carlyle's Essay on Burns.

From one of the last four books in the list a theme will be taken for the composition which forms a part of the examination paper.

The student is also urged to the fullest possible use of all the opportunities for vocal culture which his means of preparation afford.

Attention is called to the fact that the right is reserved to regard hereafter all examination papers, upon whatever subject, as part of the English examination.

The books suggested for 1900 are as follows:

Dryden's Palamon and Arcite; Pope's translation of the Iliad, Books I, VI, XXII, XXIV; the Sir Roger de Coverly Papers in The Spectator; Goldsmith's Vicar of Wakefield; Scott's Ivanhoe; De Quincey's Flight of a Tartar Tribe; Cooper's Last of the Mohicans; Tennyson's Princess; Lowell's Vision of Sir Launfal; Shakespeare's Macbeth; Milton's Paradise Lost, Books I, II; Burke's Speech on Conciliation; Macaulay's Essays on Milton and Addison.

It is recommended that candidates have a knowledge of Latin Grammar, although an examination in it is not required for any courses except the Classical and the Latin-Scientific.

2. *American History*, with the elements of civic government. [Montgomery's Leading Facts of American History and Fiske's Civil Government may serve to indicate the amount and character of this requirement. Geographical knowledge, to be tested by a reference to an outline map, will form part of this examination.]

3. *Algebra.*—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities. Equations of the first and second degrees. Ratio. Proportion and progressions.

4. *Geometry.*—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures. Regular polygons. Measurement of the circle.

Maxima and minima of plane figures, and plane and polyhedral angles. Solid Geometry.

Candidates must have a knowledge of the metric system and be prepared to solve problems in either Algebra or Geometry involving the use of the metrical units.

In 1900 and thereafter the requirements for admission to all Courses in the School of Technology will include Plane Trigonometry and Logarithms, through the solution of right and oblique triangles.

[Wells's New Plane and Spherical Trigonometry and Hussey's five-place Mathematical Tables are used in the University and are recommended for preparation, but their use is not obligatory.]

5. *Elementary Physics.*—Especial stress is laid upon the candidate's acquaintance with physical phenomena and with the simpler applications of physical laws. The ability to solve advanced or complicated mathematical problems is not required. The character of the examination is indicated by the set of questions given in this Register under the heading "Entrance Examination Papers."

[Nichols's Outlines of Physics, Gage's Elements of Physics, or Avery's Elements of Natural Philosophy (revised edition).]

6. *German.* — This requirement will be satisfied by the completion of an amount equivalent to Part I of Joynes-Meissner's or Calvin Thomas's Grammar, Buchheim's Reader, and additional reading.

[An equivalent amount of French will be accepted in cases in which it is inconvenient for the candidate to offer German. The amount thus required in French is equivalent to Whitney's Practical Grammar and Super's Reader, with additional reading.]

The candidate is expected to have acquired the ability to understand simple German (or French) prose, by the careful reading of about two hundred duodecimo pages, in addition to the study of Grammar. His proficiency will be tested by questions on the rudiments of grammar, by translations of simple English sentences, and by translations at sight of passages of easy German (or French) prose, containing no rare words.

Division of Examinations for Admission.

Candidates for admission to the Freshman Class may pass all the examinations in June, or all in September, or partly in June and partly in September, or may take them in *two consecutive years*. In the latter case, for the Technical courses and the course in Science and Letters, candidates may present themselves for examination in the first year in the following subjects: English, History of the United States, and German. No credit will be given unless the candidate has passed satisfactorily in at least two subjects in one year.

The examinations in Algebra, Plane and Solid Geometry, and Physics must be passed in June or September of that year in which the candidate proposes to enter the University.

In the Latin-Scientific and Classical courses candidates may present themselves for examination in the first year in the following subjects: English, History of the United States, Roman History, and Greek History. No credit will be given unless the candidate has passed at least three of the subjects in one year.

The examination in Latin may also be divided, but no credit will be given unless the candidate has passed in at least three of the topics specified at one examination. The examinations in the remaining subjects must be passed in June or September of that year in which the candidate proposes to enter the University.

Candidates intending to enter the University in September are advised to present themselves for examination in June; if they are not fully prepared at that time they will receive credit for the examinations then satisfactorily passed.

CONDITIONAL ADMISSION.

A candidate failing to pass in one or more of the subjects required for admission may, at the discretion of the Faculty, be admitted to his class conditionally, to make up his deficiencies by extra study. When they are made up, he will be received into full standing in his class.

SPECIAL STUDENTS.

Young men of advanced standing, who do not desire to take a full regular course, can enter and select special shorter courses, with the sanction of the Faculty; but in all cases satisfactory examinations must be passed upon the subjects required for entrance to the Freshman Class.

ADMISSION TO ADVANCED STANDING.

Candidates for admission to advanced studies *in any course* are required to pass, *in addition to the entrance examinations for that course*, examinations in the work already done by the classes which they desire to enter. These examinations are held on the same days as those for entrance to the Freshman Class. The additional subjects may be found in the program of studies.

A diploma showing that a degree has been conferred, or a certificate of studies taken at another College will be received, in so far as it covers the subjects required for entrance, in lieu of the *Primary Entrance Examinations only.*

ADMISSION TO GRADUATE COURSES.

Students of this University who have taken their *first* degree, and others, on presenting a diploma of an equivalent degree conferred elsewhere, are admitted to advanced studies, according to the plan to be found in the Register under the general subject of Graduate Students.

PREPARATORY SCHOOL CERTIFICATES.

Certificates are not accepted from any schools in lieu of examinations as evidences of proficiency in Algebra, Geometry, or German, and they will not, as a rule, be accepted in any subject. It is, however, regarded as highly desirable that the examiners should receive from principals of preparatory schools statements with reference to those whom they send up as candidates for entrance, indicating as clearly and fully as possible, in each case, the teacher's opinion of the candidate's character and scholarship and fitness for entering upon collegiate work; and such statements will receive careful consideration, in connection with the results of the entrance examinations.

PROGRAM OF STUDIES.

Showing the number of Exercises per week for each subject and the Text-books Used.

The following is presented as the general program of instruction, subject to such modifications from time to time as the Faculty may deem expedient, with the approval of the Trustees.

The names of the text-books studied are generally mentioned. The number of exercises per week in each subject is indicated by the figure in parentheses immediately following.

Two hours of drawing, three of work in the laboratory, or three of practice in the field, are regarded as equivalent to a recitation or lecture of one hour's duration.

SCHOOL OF GENERAL LITERATURE.

I. In the Classical Course, the program of studies for the first two years consists mainly of required studies, the greater part of the time being given to Greek, Latin, Mathematics, and English. To these are added, during the Freshman Year, courses in Physiology and in Greek and Roman History. In the Sophomore Year, the study of History is continued; a modern language is begun; and thorough courses are given in the elements of Chemistry and Physics. During the Junior and Senior Years the required studies include courses in History, Politics, and Economics; in Psychology and Philosophy; in Astronomy; and in English and French or German. Under the elective system now offered, the student may, if he chooses, continue throughout his course the study of Greek, Latin, Anglo-Saxon, and kindred subjects; or he may substitute for these, under the guidance and advice of the Faculty, various subjects in theoretical and applied science, as taught to his fellow students in the technical courses. It is believed that the precise and thorough methods which govern the instruction in these subjects increase their value alike for mental equipment and for discipline.

II. Students entering without a knowledge of Greek, may present for entrance either two years' work in German, or one years' work in German and additional work in Mathematics, as stated on pages 22, 23. In the former case, they are admitted to the Classical Course, and begin the study of Greek at once, carrying it on as a required subject throughout the four years. In the latter case, they are admitted to the Latin Scientific Course, in which German and other subjects take the place of Greek.

III. The Course in Science and Letters is offered for those who have had no opportunity of studying either Greek or Latin in preparation for college, the requirements for admission being the same as those prescribed for the technical courses. As in the last-named course, German is substituted for the Greek of the Classical Course, while that of Latin is occupied by an increased amount of work in theoretical and applied science.

It is believed that these courses will be found to be of especial value to those who are fitting themselves for the profession of teaching. Steps have already been taken toward adapting them more closely to this aim, and it is hoped that their usefulness to such students will be still further increased by proposed changes.

Graduates of the Classical Course receive the degree of Bachelor of Arts. Those of the Latin Scientific and Science and Letters Courses receive the degree of Bachelor of Science.

Through the kindness of friends of the University, provision has been made for the awarding of a limited number of free scholarships to students taking the Classical Course who in other respects fulfil the conditions stated on page 13.

DEPARTMENTS OF INSTRUCTION.

Greek.—The following courses are at present given in this department:

1. Xenophon: Œconomicus or Cyropaedia, with sight readings from Memorabilia or Symposium. Grammar and prose composition. Freshman Classical Required. First Term. (4)

2. Herodotus: selections, with sight readings. Freshman Classical Required. Second Term. (3)

3. Greek History: text-book and lectures. Freshman Classical, Latin Scientific, Science and Letters, Required. Second Term. (2)

4. Lysias: selected orations. Sophomore Classical Required. First Term. (3)

5. Euripides: Bacchae, Iphigenia in Tauris, or Alcestis. Sophomore Classical Required. Second Term. (3)

6. Demosthenes: Olynthiacs and Philippics, or Oration on the Crown. Sophomore Classical Elective. Second Term. (2)

7. Sophocles: Oedipus Tyrannus or Antigone. Junior Classical Elective. First Term. (3)

8a. Aeschylus: Prometheus Vinctus. Junior Classical Elective. Second Term. (3)

8b. Aristophanes: Clouds or Birds. Junior Classical Elective, alternating with 8a. Second Term. (3)

9a. Pindar: selected odes. Senior Classical Elective. First Term. (2)

9b. Homer: Odyssey, twelve books. Senior Classical Elective, alternating with 9a. First Term. (2)

10. Plato: Gorgias, Protagoras, or Phaedo. Senior Classical Elective. Second Term. (2)

A. Beginners' Course (for classical students entering with German and Latin but no Greek). Grammar and Reader. Freshman Required. Both Terms. (4)

B. Second-Year Course (for those who have taken A). Grammar and Reader continued. Xenophon. Homer. Prose composition. Sophomore Required. Both Terms. (3)

Students who have completed A and B will take courses 1, 2, 4, 5, as Required, in Junior and Senior years.

LATIN.— The following courses are given during the present year, of which the first six are required of students in the Classical and Latin-Scientific Courses; No. 3 of those also in the Course in Science and Letters. Nos. 1, 2, and 4 will be completed in Freshman Year, No. 3 begun in the second term of Freshman Year and finished the following term; Nos. 5 and 6 constitute the regular work for Sophomore Year, and No. 9 is the elective work in this department for the second term. Nos. 7 and 8 are optional during Sophomore Year for students in all courses, and the remaining courses are offered as electives during Junior and Senior Years, Nos. 11 and 12 being usually taken together.

1, 2. Cicero: De Senectute, with De Amicitia as accompanying sight reading; Livy: Books XXI and XXII, Book I being read at sight; Horace: Odes and Epodes. Prose Composition, with a careful study of Latin Grammar. Four hours a week throughout the year.

3. Roman History (Liddell's). One hour a week for a year, beginning with the second term.

4. Lectures upon ancient Topography, with a description of Rome and the principal remains in Italy and the provinces, illustrated by a full series of lantern slides. One hour a week during the second term.

5, 6. Horace: Satires, Epistles, and Ars Poetica; Tacitus' Germania, Agricola, and a portion of the Annals; Quintilian, Book X. Three hours a week throughout the year.

7. Roman Private Life, a course of lectures upon the details of this department of antiquities, fully illustrated

by lantern slides, coins, and other means. Two hours a week through the fall term.

8. The Public Antiquities of Rome, also illustrated. One hour a week in the second term.

9. Plautus: Select Plays. Two hours a week, second term.

10. Selected Letters of Cicero and Pliny the Younger. Three hours a week, first term.

11. Persius or Juvenal; Terence, several plays. Two hours a week during the second term.

12. The History of Latin Literature. One hour a week, second term.

13. Lucretius, together with a discussion of the philosophical system of the poem. Two hours a week, first term.

14. Early Latin (Allen's Remnants of Early Latin), with lectures upon the Development of the Latin Language. The last half of the term will be occupied with a course of lectures upon the History of Classical Philology. Two hours a week, second term.

ENGLISH. — During the first term, Freshman year, Rhetoric is studied, both with the aid of a text-book and through practical exercises, with the design of stimulating invention and imparting the essentials of a clear prose style. It is an advance upon the rhetorical work already done by the student and is made as far as possible a Composition Course. In the second term, a brief history of the language is made the nucleus of work. A general view of American literature is given in weekly lectures, with collateral reading.

The Sophomores spend the first term in a careful study of all that is most typical in English literature; the second, in a critical study of the prose of DeQuincey, Macaulay, and Carlyle, following that with a rapid survey of English prose from the XIV to the XIX century.

The Juniors study models of the best Oratory, both English and American, as a preliminary to the writing delivery of original orations at some time during the first term; and, during the second, specimens from the works of standard Essayists as models for original essays; with these alternate critical studies of the Elizabethan Drama. Careful training is given in the writing and criticism of essays throughout the course. These will be frequent rather than long; on subjects partly literary and in part technical; and the student will be led to maintain a specific thesis with orderly balance of arguments and arrangement of parts.

Excellence in Oratory is encouraged by the annual contest for the Alumni Prizes, held on the 22d of February, and open to students of the Junior class in all courses.

Instruction in elementary Anglo-Saxon is given regularly for one term to the Juniors in the School of General Literature, to be followed in the next term by a more critical study of the philology and history of the language than would be possible without such an introduction.

Seniors in the same school receive instruction in the Early English of Chaucer and his contemporaries, and in the principles and practice of Versification. They are required to write a short poem, or a critique of some book, of a purely literary cast, selected for their examination and review. The course is completed by a series of lectures on the English poets from Chaucer to Tennyson, and, later, by lectures on special topics in English Literature too important to be passed over with brief mention, yet too comprehensive to be treated earlier in the course. Topics for 1899 will be taken from the following list: On the life and works of Johnson and Goldsmith; of the "Lake School"; of Byron, Shelley and Keats; and of Wordsworth, Browning and Tennyson.

Optional courses will be offered as occasion arises. A Reading Club will be formed, and the student will be encouraged to such private and supplementary reading as his time will permit, and to the formation of a small library of standard books.

MODERN LANGUAGES.—Students in the Classical course are required to study either French or German, beginning with Sophomore year. Those in the Latin-Scientific and Science and Letters courses continue the study of the language presented for entrance with those in the technical courses, and take up the other with the Classical students in the Sophomore year. The courses thus given to the Classical students are as follows:

French.— 1, 2. Whitney's Practical French Grammar and Super's Reader. Two hours weekly throughout the year.

3. Grammar, continued. George Sand: La Mare au Diable. Theuriet: Bigarreau. Junior First Term. (2)

4. Taine: Les Origines de la France Contemporaine. Mérimée: Colomba. Short stories by François Coppée and Guy de Maupassant. Dictation. Compositions. Junior Second Term. (2)

5. Readings in Corneille, Racine, Molière, Victor Hugo, Alfred de Musset, and contemporary authors. Compositions. Dictation. Lectures on French Literature. Senior First Term. (2)

6. Readings. Compositions. Lectures in French on modern French authors. Senior Second Term. (2)

7. Conversation class. Optional throughout Senior Year. (1)

German.—1, 2. Brandt's Grammar, Lodeman's Manual of Exercises, and Buchheim's Reader. Two hours weekly throughout the year.

3. Grammar, continued. Beresford-Webb: German Historical Reading Book. Junior First Term. (2)

4. Jageman's Prose Composition. Dictation. Goethe: Hermann und Dorothea. Freytag: Aus dem Staate Friedrichs des Grossen. Junior Second Term. (2)

5. Readings in Lessing, Herder, Goethe, Schiller, etc., and contemporary authors. Compositions. Lectures on German literature. Senior First Term. (2)

6. Readings, continued. Compositions. Lectures in German on modern German authors. Senior Second Term. (2)

7. Conversation class. Optional throughout Senior Year. (1)

HISTORY. — The following courses are given in this department to students in the school of General Literature:

1. Greek History. (Greek 3)

2. Roman History. (Latin 3)

3. General History. Weber's Outlines of Universal History and lectures. Sophomore Second Term, Required. (2)

4. Modern History. Müller's Political History of Recent Times and lectures. Junior First Term, Required. (2)

5. American History (1607–1787). Colonial History, political and economic. Special attention is given to the social and political development of the English Colonies, and the movement toward union and independence. Junior First Term, Required. (1)

6. American History (1787–1885). In this course special emphasis is placed upon the economic, industrial, and financial history of the country from the adoption of the present constitution down to the period immediately following the Civil War. Junior Second Term, Required. (1)

The courses in American History are open to students in the School of Technology as optionals.

ECONOMICS.—The following courses in this department are offered to students in all courses of the University, 1 and 2 being required and 3 and 4 being optional for those who have taken 1 and 2:

1. Elementary Economics. A general course for beginners. Attention given to contemporary American economic problems. Junior Required, First Term. (1)

2. Economic history. Industrial changes in England and in the United States. Junior Required, Second Term. (1)

3. Modern Economics and Social Problems. Senior Elective, First Term. (1)

4. History and Development of Economic Ideas and Systems. Senior Elective, Second Term. (1)

POLITICS.—The following courses are given to students in the school of General Literature:

1. A study of the political organization of the United States, England, Canada, France, and Germany. Comparison of the organization of the typical modern governments. Study of domestic municipal organization. Senior Required. First Term. (2)

2. Study of the principles of politics and government. Relation of politics to economics. Senior Required. Second Term. (2)

MENTAL AND MORAL PHILOSOPHY. — The following courses are given to students in the School of General Literature. No. 5 is required for those in the School of Technology and the others are open to them as optionals.

1, 2. Psychology. Junior Year, Both Terms, Required. (2)

1. A short excursion into Physiological Psychology, with the phenomena of Sensation.
2. The phenomena of Reflection and Will.

3. The History of Modern Philosophy, with especial reference to the Theory of Knowledge, preceded by a brief introductory sketch of Ancient Philosophy. Senior Year, First Term, Required. (2)

4. Ethics. Senior Year, Second Term, Required. (2)

5. The Philosophy of Religion. Senior Year, Second Term, Required. (1)

MATHEMATICS.—While preparation in solid geometry is not at present required for entrance to the Classical course, it will be found of advantage for those who propose to take this course to study that subject, if opportunity offers, at the preparatory school. They will in that case be able to pursue the study of mathematics in the University in the same order as those who are taking technical courses. For those who have not studied solid geometry before entrance, the mathematical work is carried on during the Freshman and Sophomore years as follows:

1. Solid Geometry. Plane Trigonometry begun. Freshman First Term, Required. (4)

2. Plane and Spherical Trigonometry. Mensuration and use of logarithmic tables. Freshman Second Term, Required. (2)

3. Analytical Geometry. Freshman Second Term, Required. (3)

4. Advanced Algebra. Sophomore First Term, Required. (3) Those who present Solid Geometry for entrance will take this course in First Term Freshman.

5. Elementary Mechanics. Calculus begun. Sophomore or Junior First Term, Elective. (5)

6. Differential and Integral Calculus. Analytical Mechanics. Sophomore or Junior Second Term, Elective. (5)

7. Analytical Mechanics, continued. Junior or Senior First Term, Elective. (2)

ASTRONOMY.—Two courses are at present offered in this subject, as follows:

1. Descriptive Astronomy. Junior or Senior, First Term, Elective. (3)

2. Practical Astronomy, with observatory work. Junior or Senior, Second Term, Elective. (2)

CHEMISTRY.—Courses 1 and 2 are required of all students in the literary courses, being given to those in the Science and Letters course in Freshman year, and to those in the other two courses in the Sophomore year. Course 3 is elective in the Classical course and required in the other two. Students who have taken these courses are qualified to take further elective work in the quantitative laboratory as shown in the program of the course in Analytical Chemistry.

1. Lectures on General Inorganic Chemistry. Remsen. First Term. (2)

2. Laboratory work in General Chemistry. First Term. (2)

3. Lectures and laboratory work in Qualitative Analysis. Douglas and Prescott. Second Term. (3)

PHYSICS.—The following courses in General Physics are offered as required in the Science and Letters course and as elective in the other two. Students who have completed these courses may take further elective work in the Physical Laboratory as shown in the program of the course in Electrical Engineering.

1. Mechanics. Lectures and recitations. Second Term. (3)

2. Heat, electricity and magnetism. Lectures and recitations. First Term. (3)

3. Mechanics, heat. Laboratory work. First Term. (1)

4. Electricity and magnetism, light, sound. Lectures and recitations. Second Term. (3)

5. Electricity and magnetism, light, sound. Laboratory work. Second Term. (1)

PHYSIOLOGY AND HYGIENE.—Lectures. Freshman First Term, Required. (1)

MINERALOGY. — The courses in this subject given to students in the School of Technology are offered as electives in the Classical course and as required in the other two. They are

1. Crystallography. Lectures, with practical exercises in the determination of crystals. First Term, two hours weekly.

2. Mineralogy. Descriptive mineralogy, with practical exercises in the determination of minerals. Second Term, three hours weekly.

GEOLOGY.—The courses named below are required in the Science and Letters course and elective in the other two. Opportunity for more advanced study is offered in the courses given to students in Mining Engineering.

1. Lithology. Williams's Lithology, with practical exercises in determining rocks. First Term, three hours weekly.

2. Geology. Lectures and recitations. Le Conte. Second Term, three hours weekly.

DRAWING.—A course in elementary projections and free-hand sketching is required in the Latin-Scientific and Science and Letters courses, Freshman First Term, two hours weekly. More advanced courses, as given to students in the engineering courses, are offered to students in the School of General Literature as electives.

THE CLASSICAL COURSE.

FRESHMAN YEAR.

FIRST TERM.		SECOND TERM.	
Mathematics,	4	Mathematics,	5
Greek,	4	Greek and Gk. Hist.,	5
Latin,	4	Latin and Rom. Hist.,	5
English,	3	Roman Topography,	1
Physiology,	1	English,	2
	16		18

SOPHOMORE YEAR.

FIRST TERM.		SECOND TERM.	
Required.		*Required.*	
Mathematics,	3	Greek,	3
Greek,	3	Latin,	3
Latin and Rom. Hist.,	4	French or German,	2
French or German,	2	English,	2
English,	2	History,	2
Chemistry,	4		12
	18		

Optional.

Roman Antiquities,	2

Elective.

(At least four hours to be chosen.)

Greek,	2
Latin,	2
Roman Antiquities,	1
*Drawing,	4
Physics,	3
Qualitative Analysis,	3

*See C.E., M.E., and E.M. Courses.

JUNIOR YEAR.

FIRST TERM.

Required.

Psychology,	2
Political Economy,	1
American History,	1
Modern History,	2
English,	1
French or German,	2
	—
	9

Elective.

(At least seven hours to be chosen.)

Greek,	3
Latin,	3
Anglo-Saxon,	2
Mathematics,	5
Physics,	3
Physical Lab.,	1
Crystallography,	2
Toxicology,	2
Quantitative Anal.,	5

SECOND TERM.

Required.

Psychology,	2
Political Economy,	1
American History,	1
English,	1
French or German,	2
	—
	7

Elective.

(At least nine hours to be chosen.)

Greek,	3
Latin,	3
English Philology,	2
Bibliography,	2
Mathematics,	5
Physics,	3
Physical Lab.,	1
Mineralogy,	3
Quantitative Anal.,	5

SENIOR YEAR.

FIRST TERM.

Required.

Philosophy,	2
Politics,	2
	—
	4

SECOND TERM.

Required.

Ethics,	2
Politics,	2
Philosophy of Religion,	1
	—
	5

Elective. (At least eleven hours to be chosen.)		*Elective.* (At least ten hours to be chosen.)	
Greek,	2	Greek,	2
Latin,	2	Latin,	2
French or German,	2	French or German,	2
English,	2	English,	2
Political Economy,	1	Political Economy,	1
Pedagogy,	2	Astronomy,	2
Astronomy,	3	Geology,	3
Anal. Mechanics,	2	Blowpipe Analysis,	1
Lithology,	3		

The preparation of a graduating thesis forms a part of the required work of the Senior year in both terms.

In both the Junior and Senior years, technical subjects not named in the above list may be taken as elective studies subject to the advice and approval of the Faculty.

THE LATIN-SCIENTIFIC COURSE.

FRESHMAN YEAR.

FIRST TERM.		SECOND TERM.	
Mathematics,	4	Mathematics,	5
Latin,	4	Latin and Roman Hist.,	5
German,	3	Greek History,	2
English,	3	German,	3
Freehand Drawing,	2	English,	2
Physiology,	1	Roman Topography,	1
	17		18

SOPHOMORE YEAR.

FIRST TERM.		SECOND TERM.	
Latin and Roman Hist.,	4	Latin,	3
German,	2	German,	2
French,	2	French,	2
English,	2	English,	2
Chemistry,	4	History,	2
Crystallography,	2	Roman Antiquities,	1
Roman Antiquities,	2	Qualitative Analysis,	3
		Mineralogy,	3
	18		18

JUNIOR YEAR.

FIRST TERM.		SECOND TERM.	
Required.		*Required.*	
Psychology,	2	Psychology,	2
Political Economy,	1	Political Economy,	1
American History,	1	American History,	1
Modern History,	2	English,	1
English,	1	French,	2
French,	2		
	9		7
Elective.		*Elective.*	
(At least seven hours to be chosen.)		(At least nine hours to be chosen.)	
Latin,	3	Latin,	3
German,	2	German,	2
Anglo-Saxon,	2	English Philology,	2
Mathematics,	5	Bibliography,	2
Toxicology,	2	Mathematics,	5
Quantitative Anal.,	5	Physics,	3
		Quantitative Anal.,	5

SENIOR YEAR.

FIRST TERM.		SECOND TERM.	
Required.		*Required.*	
Philosophy,	2	Ethics,	2
Politics,	2	Politics,	2
		Philosophy of Religion,	1
	4		5

Elective. (At least eleven hours to be chosen.)		*Elective.* (At least ten hours to be chosen.)	
Latin,	2	Latin,	2
French,	2	French,	2
German,	2	German,	2
English,	2	English,	2
Pedagogy,	2	Political Economy,	1
Political Economy,	1	Astronomy,	2
Astronomy,	3	Geology,	3
Anal. Mechanics,	2	Blowpipe Analysis,	1
Lithology,	3		

The preparation of a graduating thesis forms a part of the required work of the Senior year in both terms.

COURSE IN SCIENCE AND LETTERS.

FRESHMAN YEAR.

FIRST TERM.		SECOND TERM.	
Mathematics,	4	Mathematics,	5
Chemistry,	4	Qualitative Analysis,	3
German,	3	Greek and Roman Hist.,	3
English,	3	German,	3
Freehand Drawing,	2	English,	2
Physiology,	1		16
	17		

SOPHOMORE YEAR.

FIRST TERM.		SECOND TERM.	
Mathematics,	5	Mathematics,	5
Quantitative Analysis,	5	Physics,	3
Roman History,	1	French,	2
French,	2	German,	2
German,	2	History,	2
English,	2	English,	2
	17		16

JUNIOR YEAR.

FIRST TERM.		SECOND TERM.	
Psychology,	2	Psychology,	2
Political Economy,	1	Political Economy,	1
American History,	1	American History,	1
Modern History,	2	French,	2
French,	2	English,	1
English,	1	English Philology,	2
Crystallography,	2	Bibliography,	2
Physics,	4	Mineralogy,	3
Anglo-Saxon,	2	Physics,	4
	17		18

SENIOR YEAR.

FIRST TERM.		SECOND TERM.	
Philosophy,	2	Ethics,	2
Politics,	2	Politics,	2
French,	2	Philosophy of Religion,	1
English,	2	Political Economy,	1
Pedagogy,	2	French,	2
Astronomy,	3	English,	2
Political Economy,	1	Astronomy,	2
Lithology,	3	Geology,	3
	17		15

The preparation of a graduating thesis forms a part of the work of Senior year in both terms.

THE SCHOOL OF TECHNOLOGY.

This school includes six distinct courses:

I. The Course in Civil Engineering.
II. The Course in Mechanical Engineering.
III. The Course in Metallurgy.
IV. The Course in Mining.
V. The Course in Electrical Engineering.
VI. The Course in Chemistry.

These have the same curriculum of studies for the first term of the Freshman year. After the first term the student follows the program of the course which he has selected.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Algebra. (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (2) Laboratory. (2)

German.—Review of Grammar, especially as to syntax. Jageman's Prose Composition. Short stories by different authors. (3) Or *French.*—Review of Grammar, especially as to syntax. George Sand: La Mare au Diable. Theuriet: Bigarreau. Short stories by François Coppée and Guy de Maupassant. (3)

Drawing.—Free-hand sketching. (2)

English.—Rhetoric. (2) Lectures. (1) Essays.

Physiology and Health.—Lectures. (1)

THE COURSE IN CIVIL ENGINEERING.

The special technical studies in this course may be grouped under the heads of Surveying, Applied Mechanics, Road and Railroad Construction, Bridge Design, and Hydraulic and Sanitary Engineering.

The work in Surveying extends over four terms and embraces land surveying, leveling, topography, triangulation, railroad reconnaissance and location, hydrography, and the elements of geodesy. A large equipment of transits, levels, and other surveying tools affords students the opportunity of becoming familiar with the instruments of different manufacturers. Much time is devoted to practice in the field and drafting-room, each student being required to become proficient in the use of instruments, in taking field notes, and in map-drawing. Particular attention is paid to the execution of topographical surveys and maps by the best modern methods. Railroad maps and profiles are made from actual field location. During the Junior year there is done secondary triangulation work of a high order of precision.

The work in Applied Mechanics comprises the strength and elasticity of materials, the theory of the equilibrium of arches, roofs, and bridges, that part of the mechanics of machinery which relates to locomotives and hoisting machines, and the theory of hydraulics and hydraulic motors. Here the theoretical principles are illustrated by examples and problems taken, as far as possible, from actual engineering practice. Tests and experiments on materials are made in the testing laboratory.

The course in Construction familiarizes the student with the qualities of materials used in engineering structures, with methods of preservation and testing, with masonry and foundations, and with the building and maintenance of roads and railroads. All the standard tests for hydraulic cements and mortars are made by each student.

The course in Bridge Design is preceded by the theory of computation of stresses by both analytical and graphic methods. Starting with the specifications for a first-class iron highway or railroad bridge, each student then makes the full computations, strain sheets, designs, working drawings, and bills of material for a plate girder, and a pin-connected truss bridge. The weight of the designed bridge is finally determined and compared with the dead load assumed for the calculations. The drawings are made and dimensioned in the same manner as in the drafting office of a bridge company. In connection with this course visits of inspection to bridges in the vicinity are regularly made.

The work in Hydraulic and Sanitary Engineering includes the study of systems of water supply, the collection, purification, and distribution of water, the combined and the separate systems of sewerage, the methods for the disposal of sewage, and the best practice for the drainage of houses. There is also a course on the flow of water in pipes and channels, together with the discussion of hydraulic motors.

Besides these special studies there is a course in Astronomy, which includes practical work in the observatory. The study of English, and of French or German, is continued, and opportunity is given for the study of Spanish. Instruction is given during four terms in crystallography, mineralogy, lithology, and geology. During the Junior and Senior years, opportunity is afforded for taking work in architecture.

The student who completes all the studies of this course will receive the degree of Civil Engineer (C.E.).

Opportunities for graduate study are offered by this department in the following subjects: Theory of Elasticity and Strength of Materials, Bridge Engineering, Railroad Engineering, Hydraulic and Sanitary Engineering, Geodesy and the Figure of the Earth.

FRESHMAN CLASS.

FIRST TERM.

See page 46.

SECOND TERM.

Mathematics.—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Physics.—Mechanics. (3)

Projection Drawing.—Descriptive geometry and isometric drawing. Tracings and drawings of structures. (4)

German.—Dictation. Compositions. Beresford-Webb: German Historical Reading Book. Freytag: Aus dem Staate Friedrichs des Grossen. Readings from Lessing, Schiller, Goethe. (3) Or *French.* Dictation. Compositions. Mérimée: Colomba. Halévy: L'Abbé Constantin. Daudet: Choix de Contes. Molière: L'Avare. Super: Readings from French History. Readings from Victor Hugo, Balzac, Dumas. (3) Conversation class in both languages optional throughout the year.

English.—History of the English language. Essays. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Elementary mechanics. Calculus begun. (5)

Physics.—Heat, electricity and magnetism. Lectures and recitations. (3) Mechanics, heat. Laboratory. (1)

Architectural Drawing.—Plans of piers and arches. Problems in stone cutting. Use of water colors. (3)

Construction.—Materials, masonry, and carpentry. Roads, streets, and pavements. Sketches of structures. (3)

English.—English literature. Essays. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus completed. Analytical mechanics. (5)

Land Surveying.—Theory and use of compass, level, and transit. Surveys and maps of farms. Leveling. (4)

Physics.—Electricity and magnetism, light, sound. (3)

Steam Engine.—Holmes's Steam Engine. (3)

English.—English prose literature. Essays. (2)

SUMMER SCHOOL.

Topographic Surveying.—Field work with transit and stadia, and with plane table. Topographic maps.

JUNIOR CLASS.

FIRST TERM.

Astronomy.—Descriptive astronomy, with problems. (3)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Work in the testing laboratory. (4)

Construction.—Foundations, arches, walls, dams, and bridges. Visits of inspection. (4)

Geodetic Surveying.—Field work in precise triangulation. Use of solar transit. Lectures on geodesy and the method of least squares. (3)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Economics.—Elementary course. (1)

SECOND TERM.

Railroad Surveying.—Theory of curves. Reconnaissance and location. Survey of a line, with maps and estimates. (4)

Roofs and Bridges.—Computation of stresses in simple trusses. (4)

Graphic Statics.—Analysis of trusses and plate girders. (3)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. (3)

Economics.—Economic problems. (1)

ELECTIVE STUDIES (one to be chosen).

Astronomy.—Practical Astronomy, with observatory work and computations. (2)

Railroads.—Maintenance of way, equipment and operation. Economic location. (2)

Architecture.—Shades, shadows, and perspective. Design for a cottage. (2)

SENIOR CLASS.

FIRST TERM.

Bridges.—Design of plate girders, riveted bridges, and pin-connected trusses, with working drawings. (6)

Hydraulics.—Hydrostatics. Flow of water through orifices, weirs, pipes, and channels. Hydraulic motors. Hydrographic surveying. (4)

Water Supply.—Collection, purification, and distribution of water. Systems of water supply. Irrigation engineering. (3)

Mechanics of Machinery.—Pile drivers, cranes, and elevators. The mechanics of the locomotive. (2)

ELECTIVE STUDIES (one to be chosen).

Geology.—Williams' Lithology, with practical exercises in determining rocks. (2)

Architecture. — History of architecture. Designs for brick and stone houses. (2)

SECOND TERM.

Bridges.—Theory of cantilever, draw, continuous, suspension, and arched structures. Specifications and contracts. (4)

Sewerage.—Systems of sewerage. Disposal and purification of sewage. House drainage. (3)

Electricity.—Equipment and operation of electric railways. Measurement of power. (2)

Philosophy of Religion.—Lectures. (1)

Preparation of Thesis. (4)

ELECTIVE STUDIES (one to be chosen).

Geology.—Historic and dynamic. Le Conte. (3)

Architecture.—Design of trainsheds and tall steel buildings. (3)

THE COURSE IN MECHANICAL ENGINEERING.

The object of this course is the study of the Science of Machines. The principal subjects taught are: the nature, equivalence, and analysis of mechanisms, the mechanics or theory of the principal classes or types of machinery, mechanical technology, the principles and practice of machine design, and the measurement of power.

Through the kindness of the officers of the Lehigh Valley Railroad Company and of the officers of the Bethlehem Iron Company, the students of the Lehigh University have access to all the shops of the Railroad from New York to Buffalo and to all the departments and shops of the immense Iron Works, in which the iron and steel industry has reached its highest development in this country. In this manufacture may be seen every process, from the smelting of the ore to the finishing of great shafts, cranks, and armor plates for the navies of the world, and to the finishing of 16-inch breech-loading rifled guns for the War Department of the United States. These extraordinary privileges are thoroughly appreciated by the Mechanical Engineering Department and are utilized in every part of its work.

The earliest shop visits are for the purpose of acquainting beginners with machine parts and the usual tools of a shop. These visits are a part of the work of a Summer School, lasting four weeks, which is held at the close of the second term of Freshman year. A classified and numbered list of some three hundred and sixty items is given to each student, who makes a written report on them with free-hand sketches containing the leading dimensions. The class is divided into sections, which are separately taken into the shops by the instructor, who then indicates the pieces that are to be examined and gives all necessary explanations. Thus at the very beginning of the course the student is brought into direct contact with the elements of machinery and the common resources of the shop, becomes familiar with technical terms, and is in a position to understand and appreciate subsequent instruction.

In this same Summer School the students of Mechanical Engineering are also given a course in the examination of the mechanical construction of electrical instruments and machinery and in the inspection of their use and operation in electrical plants. This is regarded as a very desirable preliminary to the study of Physics and to the special course in Electrical Engineering which they pursue later on.

That the students may obtain the practical engineering data which they will most need when beginning their work as mechanical engineers they are next required to pursue a course of shop instruction (Mechanical Technology), which does not necessarily involve manual labor and manipulation of tools, but is principally devoted to familiarizing them with those points in pattern-making, moulding, forging, fitting and finishing, which they need to know as designers of machinery. Particular attention is, therefore, directed to the forms and sizes of machine parts that can be readily constructed in the various workshops; to the time that it takes to perform, and the order of, the various operations; to the dimensions most needed by workmen, and to the various devices for increasing the accuracy of the work, durability of the parts, and convenience of manipulation.

That the students may learn to observe carefully and be trained to think and observe for themselves in these matters, there is required of them a full description of the various processes, operations, and tools involved in the production of each one of a series of properly graded examples of patterns, castings, forgings, and finished pieces, which are not under construction in the shops at the time and the drawings for which have been given to them on entering the shops. The student's work is directed not only by these drawings and by the printed program given him at the start, but also personally by a teacher, who accompanies him in each shop, gives necessary explanations, and tests the extent and accuracy of his knowledge. Three teachers are engaged in this work, one for each shop and section. Hereafter this study of Mechanical Technology will be carried on in a Summer School lasting four weeks, which will be held at the end of the Sophomore year.

During the course there are frequent visits of inspection to the Bethlehem Iron Company, to the L. V. R. R. shops at Easton, and to other engineering works both in and out of town, with special reference to such subjects as prime movers, machinery for lifting, handling, and transporting, and machinery for changing the form and size of materials. It is intended that each of these excursions shall have some definite purpose in view which must be fully reported by the students. These visits are also made the occasion for continued practice in the free-hand sketching of machinery.

The instruction in Machine Design begins with the second term of the Freshman year and is continued throughout the course. At first tracings and blue prints of good examples of drawings of machinery are made. A thorough drill in projection drawing follows; in this work free-hand sketches are first made, and measurements taken, of machine pieces; these sketches are then converted into full-size working drawings. Then there is considerable practice in the interpretation of such drawings, and general views of lathes, planers, drills, and shapers are made from the drawings of the details. This is followed by difficult projections and intersections and exercises in the empirical proportioning of machine parts. Both empirical and rational formulas are used to determine the dimensions of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods, the data being given as they would arise in practice and the drawings made full size. During the Junior year the class takes up the design of a high-speed steam engine, every dimension being determined by the students and complete drawings made. During the Senior year the students undertake the calculations, estimates, and working drawings involved in the design of a simple but complete machine, each student being engaged upon a different machine. In the case of these machines and of the engine the general plan of arrangement will be given to the students in the form of rough sketches, photographs, or woodcuts. In the last term the students are expected to make original designs for simple machinery, whose object has been fully explained. Throughout the course the work in the drafting-room is carried on as nearly as possible like that of an engineering establishment, and special attention is paid to methods of expediting the work of calculating by means of simple formulas, tables, and diagrams.

The students in Mechanical Engineering are given a special course in Electrical Engineering after they have finished the regular and general course in Physics. The object is to impart a clear conception of electrical units and a working knowledge of resistance, impedance, inductance, reactance, capacity, and the magnetism of iron, and the magnetic circuit as used in the construction of electrical machinery. Attention is then directed to the theory and calculation of direct current dynamos, to the study of variable and alternating current phenomena, and to the theory of the alternating current transformer. Practical problems are given in these subjects to show their application. The laboratory work which accompanies this special course involves tests of resistance, insulation, consumption of energy, and efficiency. Instruction is also given in locating and remedying the common faults of dynamos and motors.

The course in measurement of power involves much practice with the indicator. Cards are taken from the many types of engines running in the shops and power houses of the vicinity, and thorough drill is given in working up and interpreting these cards. There are also experiments with dynamometers of the friction-brake, belt, float, and cradle varieties. The work in boiler testing usually includes a test of the boilers of the University, a combined engine and boiler test at one of the silk mills, and a test of the boilers and pumping engine of the Water Works. With the engines belonging to the University tests of governor action are made. In addition there are experiments with calorimeters, duty tests of injectors and small pumps, and practice in gas and coal analysis.

After consultation with the head of the department a part, not exceeding one-fourth, of the work peculiar to this course may be replaced by an equivalent amount of work in Electricity.

All the students in this course are required to study both German and French.

The graduates in this course will receive the degree of Mechanical Engineer (M.E.).

FRESHMAN CLASS.

FIRST TERM.

See page 46.

SECOND TERM.

Mathematics. — Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Physics.—Mechanics. (3)

Drawing and Machine Design.—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of machine drawing by isometric sketches. General views from given details. Sections of stub ends and valve passages. Intersection of boiler flues. Empirical proportioning of machine parts. (4)

German.—Dictation. Compositions. Beresford-Webb: German Historical Reading Book. Freytag: Aus dem Staate Friedrichs des Grossen. Readings from Lessing, Schiller, Goethe. (3) Or *French.*—Dictation. Compositions. Mérimée: Colomba. Halévy: L'Abbé Constantin. Daudet: Choix de Contes. Moliére: L'Avare. Super: Readings from French History. Readings from Victor Hugo, Balzac, Dumas. (3) Conversation class in both languages optional throughout the year.

English.—History of the English language. Essays. (2)

SUMMER SCHOOL.

Visits of Inspection.—Examination and sketching of machine parts and of electrical apparatus and machinery.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Elementary mechanics. Calculus begun. (5)

Physics.—Heat, electricity and magnetism. Lectures and recitations. (3) Mechanics, heat. Laboratory. (1)

Machine Design.—Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers, and connecting rods. (3)

Boilers.—Peabody and Miller. Strength, construction, and wear and tear of boilers. (1)

French.—Whitney's Practical French Grammar. Super's Reader. (2) Or *German.*—Joynes-Meissner's Grammar. Buchheim's Reader. (2)

English.—English literature. Essays. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus, completed. Analytical mechanics. (5)

Physics.—Electricity and magnetism, light, sound. Lectures and recitations. (3) Laboratory. (1)

Steam Engine.—Holmes's Steam Engine. (4)

French.—Grammar and Reader (continued). (2) Or *German.*—Grammar and Reader (continued). Short stories by different modern authors. (2)

English.—English prose literature. Essays. (2)

SUMMER SCHOOL.

Mechanical Technology.—Shop instruction. Examination of the processes and appliances involved in pattern-making, moulding, forging, fitting, and finishing.

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Analytical Mechanics, continued. (2)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Work in the testing laboratory. (4)

Mechanics of Machinery.—Herrmann-Smith. Graphical Statics of Mechanisms. (2)

Electro-technology.—Theory of magnetism. Direct and alternating currents. Dynamos and motors. Electric light and power. (5)

French.—Advanced grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Advanced grammar. Short stories by different modern authors. (2)

Economics.—Elementary economics. (1)

English.—English and American Orators. (1)

SECOND TERM.

Metallurgy. — Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (5)

Machine Design.—Calculations and working drawings for a high-speed steam engine. (4)

Machinery of Transmission.—Weisbach-Herrmann. (3)

Dynamo Laboratory. — Testing out. Insulation and conductivity tests. Dynamo and motor tests, and location of faults. (1)

French. — Advanced grammar. Short stories by François Coppée and Guy de Maupassant. Vigny: Le Cachet Rouge. Dictation. (2) Or *German.*—Advanced grammar. Beresford - Webb: German Historical Reading Book. Freytag: Aus dem Staate Friedrichs des Grossen. Dictation. (2)

Economics.—Economic problems. (1)

English.—British Essayists. (1)

SENIOR CLASS.

FIRST TERM.

Thermodynamics.—General principles; application to steam engines and air compressors. (3)

Kinematics of Machinery.—Nature and equivalence of mechanisms. Diagrams of the changes of position, speed, and acceleration in mechanisms. Valve and link motions. (5)

Graphical Statics.—Graphical analysis of roof trusses and girders. (2)

Machine Design.—Calculations and working drawings for hoisting, pumping, and metal-working machinery. (4)

Measurement of Power. — Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

Mechanics of Machinery.—Weisbach-Herrmann. Hoisting machinery, accumulators, cranes, and locomotives. (2)

SECOND TERM.

Mechanics of Machinery.—Weisbach-Herrmann. Pumps, pumping engines, blowing engines, compressors, and fans. (4)

Machine Design.—Original designs. (5)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (3)

Measurement of Power.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

Philosophy of Religion.—Lectures. (1)

Preparation of Thesis.

THE COURSES IN MINING ENGINEERING.

These courses aim to fit the student for practical work in either of the branches of mining, metallurgy, metallurgical chemistry, or geology. On account of the great number and scope of the studies necessary to the attainment of the degree of Engineer of Mines (E.M.), which includes that of Metallurgist, five years are required. At the end of the fourth year the student will have completed a course similar to that leading to the scientific degree in other institutions, and will receive the degree of Bachelor of Science (B.S.) in either mining or metallurgy. The following program of subjects and studies shows the requirements for the degree of Engineer of Mines.

MODERN LANGUAGES.—Although the option of studying French or German lies with the student, it may be well to note that the current literature of the subjects taught in these courses is more abundant in the latter language.

DRAWING AND CONSTRUCTION.—The course in mechanical drawing begins with tracings of good examples of machine drawings; then follow the interpretation of such drawings, and the making of general views of machines from detailed sketches, exercises in projection drawing from the same, and the proportioning of simple tools and machines.

A brief course in descriptive geometry is given, in which the student is grounded in the fundamental principles of the subject. The simpler applications are given in the form of problems, and a number of practical examples are worked out in the drawing room.

Under the charge of an instructor, the students make visits of inspection to mines and metallurgical works, during which they examine and make sketches of portions of the plant, and take notes concerning it. From these sketches and notes they subsequently make working drawings accompanied by written memoirs explanatory of the construction and operation of the plant.

In a later portion of the course the students are required to make original designs for mining and metallurgical plant under given conditions, involving exercise in the adaptation and proportioning of structures, machinery, and apparatus to suit the conditions given.

The field work in mining and geological surveying is followed by map construction from field notes.

CHEMISTRY. — The course in theoretical and applied chemistry extends over three years and includes work in wet and dry assaying of all the important ores and metallurgical products met with in actual practice, combined with the working of stoichiometric problems and the study of chemical philosophy. The practical work is that required for a metallurgical chemist or assayer.

With moderate care the expenses in this department need not exceed $120.

MINERALOGY.—This subject is divided into two courses. In the first course, after a short exposition of the laws of crystallography and a description of crystalline forms, practical exercises are held in the determination of simple and complex crystals, in which the student is taught to identify the various crystalline forms observed in minerals by the aid of models and of actual crystals, and with the use of the application goniometer. The second course includes the subjects of physical, descriptive, and determinative mineralogy. As in the first course, the greater part of the time is devoted to practical exercises, which, in this course, have for their object the determination of minerals. Each student is thus enabled to become familiar with the more common minerals by the actual handling of several hundred specimens, with the facility of making such tests as will not injure them. The presence of one or more instructors during each exercise permits the student to make frequent reports of his determinations, and to receive much instruction as to the characteristics of the minerals. The knowledge thus acquired can be supplemented by visits to the museum.

The course in blowpipe analysis may be considered as auxiliary to the practical exercises in determinative mineralogy. In the latter the student is urged to rely chiefly on physical tests; in the former he is required to determine minerals by the aid of the blowpipe. An elective course in quantitative blowpipe analysis is open to a limited number of students. Those wishing to take this course must have taken the elementary course in blowpipe analysis, or its equivalent, and must obtain permission from the Faculty.

The mineralogical laboratory offers facilities for an advanced course in crystallography and in physical and microscopic mineralogy to a few students who may receive permission to pursue such a course.

GEOLOGY.—This subject is studied with special reference to the needs of the mining engineer. Within a radius of twenty miles the student meets and becomes acquainted with the rocks of the archæan, the palæozoic, and the mesozoic formations, and makes geological maps from his own field notes, paying attention to the lithological characters of the formations, as they are mainly non-fossiliferous south of the Blue Ridge. An extended practical course in lithology familiarizes the student with the rocks of importance to the mining engineer and enables him to determine them by sight. There are over 2,500 specimens in the collections, embracing nearly all the known species. The course in historic geology is illustrated by a cabinet of typical specimens. The course in economic geology supplements the above work by familiarizing the student with the geological horizon of all the valuable constituents of the earth's crust and the theories of their formation. As Bethlehem is near the center of the "extra morainic" drift, exceptional facilities are afforded for the study of pleistocene geology in Eastern Pennsylvania.

APPLIED MECHANICS.—This embraces hydraulics, a study of the steam engine, and the mechanics of machines employed in mining and metallurgy.

SURVEYING.—A course extending over five terms offers practice in land, mine, and geological surveying, leveling, topography, triangulation, railroad reconnaissance and location, and the use of the solar transit. It also includes practical work in drawing and map construction.

Candidates for the degree of B. S. in Mining will be required to take the course of topographical surveying in the Summer School at the end of the Sophomore year. Candidates for the degree of E. M., who have taken the degree of B. S. in Metallurgy, will be required to take the course of topographical surveying in the Summer School at the end of the Senior year. Students in Metallurgy may fulfill this requirement in anticipation by taking this course in the Summer School at the end of either the Sophomore or the Junior year.

METALLURGY.—There are two courses, making, together, about one hundred and forty lectures on this subject, which extend throughout a year. In these the chief object kept in view is a clear presentation of the principles involved in the various metallurgical processes, looked upon as the application to practice of the laws of chemistry, physics, and mechanics. This is followed, in the case of each process, by a description of the more important examples of the plant and of the methods of conducting the process, and by indications concerning its economic features. In order to ensure the student's understanding the fundamental principles of metallurgy, and his becoming so familiar with them as to be able readily to apply them, he is required to solve a series of problems in which these principles are involved. Many of the problems are such as are likely to present themselves to the metallurgist in his current practice.

The metallurgical laboratory affords opportunity for special investigations in subjects connected with metallurgy to such advanced students as are competent to conduct them.

MINING.—This subject is covered by three courses. The first begins with the application of economic geology to the needs of the engineer, so that he can study and value mining properties, locate appropriately the necessary plant, and calculate the cost of production. It includes the discussion of faults and the means of finding faulted bodies, with practical problems. The subjects of blasting, timbering, and winning deposits are applied to actual cases, as tunnel-driving, etc., and problems from practical data are solved by the students. The second course covers the subjects of underground and surface haulage; loading, unloading, and stocking ores; pumping; ventilation; hygiene and mining law. A series of problems is given in each of these subjects to cover cases that meet the engineer in ordinary practice. The third course treats of the mechanical preparation of ores by the wet, dry, or magnetic methods, and especially of the preparation of anthracite coal.

The location of the University in the vicinity of the iron works of the Lehigh Valley, and especially of the extensive establishment of the Bethlehem Iron Company, affords unusual facilities for the practical study of iron metallurgy. The processes for manufacture of spelter and oxide of zinc may be studied at the works of the Lehigh Zinc and Iron Co. The facilities for the practical study of mining and economic geology are not excelled by those of any other institution in the country. The zinc mines at Friedensville, the paint ores of the Marcellus formation, and the brown hematite and slate deposits of the Lehigh Valley are in the immediate vicinity, while within easy reach by rail are the semi-bituminous and anthracite coal fields, the block and fossil iron ores of the Clinton measures, the iron mines at Cornwall, Pennsylvania, and the iron and zinc mines of New Jersey; together affording examples of nearly all the methods of winning and dressing valuable deposits. Numerous visits of inspection are made in connection with the work of the course, to familiarize the student with metallurgical and mining processes and afford data for practical examples and projects.

THE COURSE IN METALLURGY.

This course is arranged so that the subjects which prepare the student for practice in the field of metallurgy shall be completed at the end of four years, when the graduate will receive the degree of Bachelor of Science in Metallurgy (B.S.). By remaining a year longer, and taking the subjects laid down for the graduate year, the graduate in the course may obtain the degree of Engineer of Mines (E.M.).

FRESHMAN CLASS.

FIRST TERM.

See page 46.

SECOND TERM.

Mathematics.—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Drawing. — Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of drawings by isometric sketches. General views from given details. Sections of simple construction. Intersections of spheres, cones, cylinders, etc., accompanying the study of descriptive geometry and illustrated from examples of mining and metallurgical plant. (4)

Physics.—Mechanics. (3)

German.—Dictation. Compositions. Beresford-Webb: German Historical Reading Book. Freytag: Aus dem Staate Friedrichs des Grossen. Readings from Lessing, Schiller, Goethe. (3) Or *French.*—Dictation. Compositions. Mérimée: Colomba. Halévy: L'Abbe Constantin. Daudet: Choix de Contes. Moliére: L'Avare. Super: Readings from French History. Readings from Victor Hugo, Balzac, Dumas. (3) Conversation class in both languages optional throughout the year.

English.—History of the English language. Essays. (2)

SUMMER SCHOOL.

Visits of Inspection. — Examination and sketching of machine parts and of electrical apparatus and machinery.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Elementary mechanics. Calculus begun. (5)

Physics.—Heat, electricity and magnetism. Lectures and recitations. (3) Mechanics, heat. Laboratory. (1)

Drawing.—Flat tinting with water colors. Graphical problems illustrating the direction and extent of throw in faults. Examination and sketching of metallurgical plant in the vicinity. General views and working drawings of the plant examined, accompanied by written descriptions of its construction and operation. (4)

Land Surveying.—Theory and use of level and transit. Field practice and map-drawing. (2)

English.—English literature. Essays. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus, completed. Analytical mechanics. (5)

Physics.—Electricity and magnetism, light, sound. (3)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (5)

Stoichiometry. (2)

English.—English prose literature. Essays. (2)

JUNIOR CLASS.

FIRST TERM.

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Work in the testing laboratory. (4)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Chemistry.—Fresenius's Quantitative Analysis. Laboratory work. (3) The following analyses are executed by the student:

1. Iron wire (Fe).
2. Potassium Dichromate (Cr_2O_3).
3. Copper ore (Cu).
4. Zinc ore (Zn): by both gravimetric and volumetric methods.
5. Lead ore (Pb, S).
6. Silver coin (Au, Ag, Pb, Zn).

Chemical Philosophy.—Tilden. Chemical calculations. Thorpe and Tate. (3)

Assaying.—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

Economics.—Elementary economics. (1)

English.—English and American Orators. (1)

SECOND TERM.

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Chemistry.—Fresenius's Quantitative Analysis. Laboratory work. (3) The following analyses are executed by the student:

7. Copper alloys (Cu, Sn, Zn, Pb).
8. Spiegeleisen (Mn): by both gravimetric and volumetric methods.
9. Iron ore (complete analysis).

10. Limestone (complete analysis).
11. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).

Steam Engine.—Holmes's Steam Engine. (4)

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (5)

Economics.—Economic problems. (1)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of copper, lead, silver, gold, etc. (4)

Blow-Pipe Analysis.—Practice. (1)

Lithology.—Williams's Lithology, with practical exercises in determining rocks. (3)

Chemistry.—Fresenius's Quantitative Analysis. Laboratory work. (4) The following analyses are executed by the student:

12. Slag (complete analysis).
13. Pig iron (complete analysis).
14. Carbon in steel (volumetric).
15. Nickel ore (Ni, Co).
16. Gas analysis.

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (3)

Measurement of Power.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

SECOND TERM.

Ore Dressing.— Mechanical preparation of ores. Coal washing. Lectures. (3)

Drawing.—Designing of furnaces and other metallurgical plant. (2)

Mechanics of Machinery.—Hoisting machinery, accumulators, pumps, pumping-engines, blowing-engines, compressors, and fans. (4)

Geology.—General geological definitions and principles. Dynamic geology: Dana. Lectures. (2)

Measurement of Power. (1)
Philosophy of Religion.—Lectures. (1)
Preparation of Thesis.

SUMMER SCHOOL.*

Topographic Surveying.—Field work with transit and stadia and with plane table. Topographic maps.

GRADUATE YEAR.

FIRST TERM.

Mining. — Prospecting. Economic geology. Boring. Valuation of property. Timbering and walling. Support of excavations. Tunneling. Systems of mining. Lectures. (4)

Mechanics of Machinery.—Herrmann-Smith. Graphical Statics of Mechanisms. (2)

Drawing.—General views of mining plant and detailed sketches. (5)

Geodetic Surveying.—Use of solar transit and sextant. Precise triangulation. Elements of geodesy. Determination of the systematic errors of instruments. (3)

Mine Surveying.—Theory and problems, with maps drawn from actual surveys. (2)

SECOND TERM.

Projects.—In mining. Designing of mining plant. (4)

Mining.—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Lectures. (4)

Geological Surveying. Theory, practice, and map drawing. (2)

Railroad Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. (4)

Preparation of Thesis.

THE COURSE IN MINING.

This course is arranged so that the subjects included in the practice of mining and ore dressing will be covered in four years, when the graduate will receive the degree of

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*For candidates for the degree of E. M.

Bachelor of Science in Mining (B.S.), and by an additional year of post-graduate work can obtain that of Engineer of Mines (E.M.).

FRESHMAN CLASS.

FIRST TERM.

See page 46.

SECOND TERM.

Mathematics.—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Physics.—Mechanics. (3)

Drawing.—Tracings and blue prints. Sections of simple construction. Intersections of spheres, cones, cylinders, etc., illustrated from examples of mining and metallurgical plant. (4)

German.—Dictation. Compositions. Beresford - Webb: German Historical Reading Book. Freytag: Aus dem Staate Friedrichs des Grossen. Readings from Lessing, Schiller, Goethe. (3) Or *French.*—Dictation. Compositions. Mérimée: Colomba. Halévy: L'Abbé Constantin. Daudet: Choix de Contes. Moliére: L'Avare. Super: Readings from French History. Readings from Victor Hugo, Balzac, Dumas. (3) Conversation class in both languages optional throughout the year.

English.—History of the English language. Essays. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Elementary mechanics. Calculus begun. (5)

Drawing.—Sketches and working drawings of machine pieces. Interpretation of drawings by isometric sketches. General views from given details. Graphical problems illustrating the direction and extent of throw in faults. (2)

Physics.—Heat, electricity, and magnetism. Lectures and recitations. (3) Mechanics, heat. Laboratory. (1)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Land Surveying.—Theory and use of level and transit. Field practice and map-drawing. (2)

English.—English literature. Essays. (2)

SECOND TERM.

Mathematics. — Differential and integral calculus, completed. Analytical mechanics. (5)

Physics.—Electricity and magnetism, light, sound. (3)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

Blowpipe Analysis. — Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (3)

English.—English prose literature. Essays. (2)

SUMMER SCHOOL.

Topographic Surveying.—Field work with transit and stadia, and with plane table. Topographic maps.

JUNIOR CLASS.

FIRST TERM.

Mining.—Prospecting. Economic geology. Boring. Valuation of property. Timbering and walling. Support of excavations. Tunneling. Systems of mining. Lectures. (4)

Lithology.—Williams's Lithology, with practical exercises in determining rocks. (3)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Work in the testing laboratory. (4)

Assaying.—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

Economics.—Elementary course. (1)

English.—English and American Orators. (1)

SECOND TERM.

Geology.—General geological definitions and principles. Dynamic and historic geology. Lectures. Dana. (4)

Mining.—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Lectures. (4)

Ore Dressing. — Mechanical preparation of ores. Coal washing. (3)

Steam Engine.—Holmes's Steam Engine. (4)

Economics.—Economic problems. (1)

SENIOR CLASS.

FIRST TERM.

Drawing.— General views of mining plant and detailed sketches. (5)

Geodetic Surveying.—Use of solar transit and sextant. Precise triangulation. Elements of geodesy. Determination of the systematic errors of instruments. (3)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (3)

Mechanics of Machinery. — Herrmann-Smith. The Graphical Statics of Mechanisms. (2)

Mine Surveying.—Theory and problems, with maps drawn from actual surveys. (2)

Measurement of Power.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

SECOND TERM.

Projects.—In mining. Designing of mining plant. (4)

Railroad Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. (4)

Mechanics of Machinery. —Hoisting machinery, accumulators, pumps, pumping-engines, blowing-engines, compressors, and fans. (4)

Geological Surveying.—Theory, practice, map-drawing. (2)

Measurement of Power.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

Philosophy of Religion.—Lectures. (1)

Preparation of Thesis.

GRADUATE YEAR.

FIRST TERM.

Chemical Philosophy. — Tilden. Chemical calculations. Thorpe and Tate. (3)

Blowpipe Analysis.—Practice. (1)

Metallurgy.—Of copper, lead, silver, gold, etc. (4)

Drawing.—Metallurgical construction. (4)

Chemistry.—Fresenius's Quantitative Analysis. Laboratory work. (5) The following analyses are executed by the student:

1. Iron wire (Fe).
2. Potassium Dichromate (Cr_2O_3).
3. Copper ore (Cu).
4. Zinc ore (Zn): by both gravimetric and volumetric methods.
5. Lead ore (Pb, S).
6. Silver coin (Au, Ag, Pb, Zn).
7. Copper alloys (Cu, Sn, Zn, Pb).
8. Spiegeleisen (Mn): by both gravimetric and volumetric methods.

SECOND TERM.

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (5)

Drawing.—Metallurgical design. (2)

Chemistry.—Fresenius's Quantitative Analysis. Laboratory work. (6) The following analyses are executed by the student:

9. Iron ore (complete analysis).
10. Limestone (complete analysis).
11. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).
12. Slag (complete analysis).
13. Pig iron (complete analysis).
14. Carbon in steel (volumetric).
15. Nickel ore (Ni, Co).
16. Gas analysis.

Thesis.

THE COURSE IN ELECTRICAL ENGINEERING.

The object of this course is to provide instruction in the elementary sciences, mathematics, and electrotechnology, supplemented by the study of the strength of materials, the mechanics of machinery, machine design, thermodynamics, and hydraulics.

The elementary course in Mechanics, Heat, Electricity and Magnetism, Light, and Sound begins with the second term of the Freshman year and extends to the end of the Sophomore year. This work is common to all the technical courses.

Students in Electrical Engineering pursue the mathematical theory of electricity and magnetism during the first term of the Junior year and an extended course in the electrical laboratory throughout the Junior year. The electrotechnical work begins with the second term of the Junior year, when the student takes up the technical study of telegraphs and telephones and begins the elementary theory of dynamos and motors and the theory of alternating currents. The Senior year is devoted to electrical designing, the theory of alternating currents, electric lighting, power transmission, dynamo laboratory and heavy electrical testing, electro-metallurgy, and thesis work.

A laboratory fee is charged to students to cover the cost of laboratory supplies. Students taking one laboratory exercise per week are required to pay $3.50 per term: students taking two laboratory exercises per week are required to pay $5.00 per term; and students taking three laboratory exercises per week are required to pay $6.50 per term.

After consultation with the head of the department, a part, not exceeding one-fourth, of the work peculiar to this course may be replaced by an equivalent amount of work in Mechanical Engineering.

The student who completes all the studies of this course will receive the degree of Electrical Engineer (E.E.).

For the benefit of graduates in Electrical Engineering who desire to study the advanced portions of electrical science, instruction is offered in the mathematical theory of electricity and magnetism, in the advanced theory of alternating currents, and in mathematical physics in general.

FRESHMAN CLASS.

FIRST TERM.

See page 46.

SECOND TERM.

Mathematics.—Analytical geometry. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Physics.—Mechanics. (3)

Drawing and Machine Design.—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of machine drawing by isometric sketches. General views from given details. Sections of stub ends and valve passages. Intersection of boiler flues. Empirical proportioning of machine parts. (4)

German.—Dictation. Compositions. Beresford - Webb : German Historical Reading Book. Freytag : Aus dem Staate Friedrichs des Grossen. Readings from Lessing, Schiller, Goethe. (3) Or *French.*—Dictation. Compositions. Mérimée : Colomba. Halévy : L'Abbé Constantin. Daudet: Choix de Contes. Molière : L'Avare. Super : Readings from French History. Readings from Victor Hugo, Balzac, Dumas. (3) Conversation class in both languages optional throughout the year.

English.—History of the English language. Essays. (2)

SUMMER SCHOOL.

Visits of Inspection.—Examination and sketching of machine parts and of electrical apparatus and machinery.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Elementary mechanics. Calculus begun. (5)

Physics. — Heat, electricity, and magnetism. Lectures and recitations. (3) Mechanics, heat. Laboratory. (1)

Machine Design.—Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers, and connecting rods. (3)

Boilers.—Peabody and Miller. Strength, construction, and wear and tear of boilers. (1)

French.—Whitney's Practical Grammar. Super's Reader. (2) Or *German.*— Joynes-Meissner's Advanced Grammar. Buchheim's Reader. (2)

English.—English literature. Essays. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus, completed. Analytical mechanics. (5)

Steam Engine.—Holmes's Steam Engine. (4)

Physics.—Electricity and magnetism, light, and sound. Lectures. (3) Physical laboratory. (1)

French. — Grammar and reader (continued). (2) Or *German.*—Grammar and reader (continued). Short stories by different modern authors. (2)

English.—English prose literature. Essays. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Analytical Mechanics, continued. (2)

Electricity.—Advanced course in the principles of electricity and magnetism. (4)

Electrical Laboratory. — Course in electrical measurements. (3)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Work in the testing laboratory. (4)

Surveying.—Theory and use of instruments. Land surveying and leveling. Location of electric railways. (2)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Advanced grammar. Short stories by different modern authors. (2)

Economics.—Elementary economics. (1)

SECOND TERM.

Dynamo-electric Machinery.—Direct-current generators and motors. Text-book: Jackson's Electro-Magnetism and the Construction of Dynamos. (3)

Electrical Designing. (1)

Alternating Currents.—The analytical and graphical treatment of alternating currents. (2)

Electrical Laboratory.—Continuation of course in electrical measurements. (2)

Telegraphs and Telephones.—Lectures. (3)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (3)

French.—Advanced Grammar. Short stories by François Coppée and Guy de Maupassant. Vigny: Le Cachet Rouge. Dictation. (2) Or *German.*—Advanced Grammar. Beresford-Webb: German Historical Reading Book. Freytag: Aus dem Staate Friedrichs des Grossen. Dictation. (2)

Economics.—Economic problems. (1)

Philosophy of Religion.—Lectures. (1)

SENIOR CLASS.

FIRST TERM.

Dynamo-electric Machinery.—Alternators and transformers. (2)

Electrical Designing.—Lectures. (2)

Alternating Currents. (2)

Electric Lighting and Station Visits. (2)

Dynamo Laboratory. (3)

Measurement of Power.—Indicating of steam engines and dynamometer experiments. (1)

Mechanics of Machinery. — Herrmann-Smith. The Graphical Statics of Mechanisms. (2)

Thermodynamics. (3)

Four lectures on recent advances in Electrical Engineering.

SECOND TERM.

Alternating Currents. (2)

Dynamo-electric Machinery.—Polyphase apparatus. (2)

Electrical Designing. (2)

Dynamo Laboratory. (3)

Electro-metallurgy.—Lectures. (1)

Electric Power and Station Visits. (2)

Hydraulics.—Flow of water through orifices, pipes, and channels. Hydraulic motors. (3)

Preparation of Thesis.

Four lectures on recent advances in Electrical Engineering.

THE COURSE IN CHEMISTRY.

This course of study is designed to prepare students for the profession of the chemist, in connection with metallurgical establishments, sugar refineries, gas works, superphosphate works, electrical machinery manufactories, mining companies, etc., and the general consulting and analytical work of the professional chemist. It is also well adapted to the preparation of teachers of chemistry and as a course preliminary to the study of medicine. It is eminently practical, the student's time being largely occupied by practical work in the large, well equipped and well ventilated chemical laboratories, which were completed in 1885 and constitute the best constructed building for this purpose in this country. The museum of chemistry contains large collections of specimens, for illustrating the lectures on theoretical and applied chemistry.

THEORETICAL CHEMISTRY.—Instruction in this subject begins with lectures twice a week, in the first term of the Freshman year. These lectures are fully illustrated by experiments, colored diagrams, working drawings and lantern pictures, and specimens from the museum. They include a general introduction to theoretical chemistry, and a description of the non-metallic and metallic elements and their compounds, the general subject of inorganic chemistry. The students are required to take notes of the lectures, and to pass a written examination at the end of the term. There is also a course of experimental chemistry in the laboratory; six hours per week are required.

In the second term of this year stoichiometry and chemical problems and reactions are taught by recitations twice each week.

The study of theoretical chemistry is continued throughout the Sophomore year by recitations three times a week from Tilden's Chemical Philosophy, Thorpe and Tate's Chemical Problems, and Remsen's Advanced Chemistry; in the first term of the Junior year, by a course of lectures and recitations on theoretical organic chemistry, four times a week. These lectures are illustrated by experiments and by specimens from the museum of chemistry.

Written examinations are held at the close of each of the above courses.

ANALYTICAL CHEMISTRY.—Qualitative analysis is taught in the second term of the Freshman year, by lectures, recitations, and practical work in the qualitative laboratory, fifteen hours of practical work per week being required. This laboratory is a large, well ventilated, and well lighted room, supplied with convenient working tables, vacuum filtration, hoods for noxious vapors, steam baths, gas and washing appliances, and a commodious room for hydrosulphuric acid. Distilled water is delivered by faucet in this room and the other large laboratories. At the close of the term a practical examination is held in this subject.

After completing this course, quantitative analysis is pursued throughout the Sophomore and the first term of the Junior years. This subject is taught by lectures, recitations, and practical work in the quantitative laboratory, which is equipped like the qualitative laboratory, but is supplied in addition with apparatus for drying precipitates and residues, rooms for the chemical balances, for combustions, and for a reference library.

Fifteen hours per week of laboratory work are required.

The course consists in gravimetric and volumetric analyses, as applied to the substances given in the lists farther on, accuracy being required in the determination of each constituent.

At the close of each term written examinations are held upon the theory and practice of quantitative analysis.

GAS ANALYSIS is taught by lectures and laboratory practice in the gas laboratory. This laboratory is supplied with full and complete apparatus for gas analysis, according to Bunsen's processes, as well as apparatus for some of the more rapid methods. Mixtures of gases are required to be analyzed by the students, within certain limits of error, and a written examination, on the theory and practice, is held at the close of the course.

ASSAYING.—The assaying of ores by furnace assay, together with gold and silver bullion analysis, by processes practiced in the United States Mint, is taught by lectures and practical work in the first term of the Senior year, nine hours of practical work per week being required. The course includes the assaying of ores of lead, tin, antimony, gold, silver, and iron, coal, and gold and silver bullion.

The assaying laboratory is supplied with large working tables, twenty-nine crucible and two iron furnaces, and eight muffle furnaces, with adjoining rooms for balances, and gold and silver bullion analysis.

A certain accuracy of results and a written examination as regards theory and practice are required.

ORGANIC CHEMISTRY.—The practical work in this subject is performed in the second term of the Junior year, eighteen hours per week being required, with conferences and recitations each week. The laboratory for this work is equipped similarly to the quantitative laboratory, in addition being supplied with steam, cold water and air blast upon the working tables, and a full supply of apparatus for the various determinations and experiments, including combustion furnaces, furnaces for heating sealed tubes, mercury pump, Hoffman's, Dumas' and Meyer's apparatus for vapor densities, nitrometers, chemical balances, etc.

The course consists of determinations of specific gravities, melting points, boiling points, vapor densities; chlorine, bromine, iodine, and sulphur of organic substances.

Combustion analysis, nitrogen determination, fractional distillation, and the preparation of fifty pure organic compounds and a number of analyses are included.

INDUSTRIAL CHEMISTRY.—A course of lectures is delivered upon this subject in the second term of the Senior year, illustrated by experiments, diagrams, lantern pictures, and specimens from the museum of chemistry. The working laboratories for this subject contain an apparatus for making illuminating gas, an alcohol still, worm and doubler, and a complete working model of a sugar refinery, including filters, vacuum pan, and centrifugal. There is also apparatus for use in the manufacture of chemicals, for dyeing, calico printing, and bleaching. In connection with these laboratories is a room containing a photometer and apparatus for determining the sulphur, ammonia, and specific gravity of illuminating gas; also a laboratory for the testing of alcoholic liquors, sugar, molasses, bone black, soap, petroleum, paints, dyes, superphosphates, tallow, illuminating and lubricating oils, rubber, explosives, paints, asphalts, and other commercial products, with the necessary technical apparatus. The students make practical experiments in this direction, and, with an instructor, visit various industrial establishments in this neighborhood and in and around New York City. Fifteen hours of laboratory work are required each week throughout the Senior year.

TOXICOLOGY.—A course of lectures on this subject is given in the first term of the Junior year, illustrated by experiments and by the large collection of specimens of poisons from the museum of chemistry. This is supplemented by a short course of laboratory work on some of the common poisons.

SANITARY CHEMISTRY.—During the second term of the Senior year attention is given to the qualitative and quantitative examination of air, water, food, disinfectants, baking-powders, flour, bread, tea, coffee, cocoa, spices, milk, butter, lard, beer, and other subjects connected with this branch of the science. Special apparatus is provided for this work, as recommended by the best authorities on the subject.

PHOTOGRAPHIC CHEMISTRY. — A well equipped photographic laboratory and dark rooms are provided, in which the students of the chemical course receive practical instruction.

PHYSIOLOGICAL CHEMISTRY.—The examination of urine, blood, organic and inorganic poisons, etc., receives a proper amount of attention.

The course also includes instruction in physics, mineralogy, blowpipe analysis, metallurgy, and geology, which are of great value to the chemist.

MICROSCOPY.—Instruction in the use of the microscope is given in the first term of the Senior year, six hours of laboratory work each week being required.

In the Senior year the student is required to prepare a thesis on some subject, selected by the Professor of Chemistry, involving practical work in the laboratory in addition to the literary labor, each graduate thus making a contribution to the progress of the science, as a preliminary to the reception of his degree.

The graduate of this course receives the degree of Analytical Chemist (A.C.).

Students, not candidates for a degree, are admitted to special courses in chemistry, of which they will receive certificates.

The laboratories are under the immediate charge of the Professor and Instructors of Chemistry and are open to the students from 8 o'clock A.M. to 6 o'clock P.M., including Saturdays. Students are at liberty to work in the laboratories beyond the required hours as their time may permit. Students are charged for materials and apparatus consumed; with moderate care this expense need not exceed $50 per year.

FRESHMAN CLASS.

FIRST TERM.

See page 46.

SECOND TERM.

Mathematics. — Plane trigonometry. Use of logarithmic tables. (1)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (5)

Physics.—Mechanics. Lectures and recitations. (3) Laboratory. (1)

Stoichiometry. (2)

German. — Dictation. Composition. Beresford-Webb: German Historical Reading Book. Freytag: Aus dem Staate Friedrichs des Grossen. Readings from Lessing, Schiller, Goethe. (3) Or *French.* — Dictation. Compositions. Mérimée: Colomba. Halévy: L'Abbé Constantin. Daudet: Choix de Contes. Molière: L'Avare. Super: Readings from French History. Readings from Victor Hugo, Balzac, Dumas. (3) Conversation class in both languages optional throughout the year.

English.—History of the English language. Essays. (2)

SOPHOMORE CLASS.

FIRST TERM.

Chemical Philosophy.— Tilden. Chemical problems. Thorpe and Tate. (3)

Quantitative Analysis.—Fresenius's Quantitative Analysis. (5) The following analyses are executed by the student:

1. Iron wire (Fe).
2. Potassium Dichromate (Cr_2O_3).
3. Barium chloride (Ba, Cl, H_2O).
4. Magnesium sulphate (MgO, SO_3, H_2O).
5. Disodium hydrogen phosphate (P_2O_5).
6. Rochelle salt (K_2O, Na_2O).
7. Volumetric determination of chlorine.
8. Acidimetry (HCl, H_2SO_4, HNO_3, $HC_2H_3O_2$).
9. Alkalimetry (KOH, NaOH, NH_4OH, soda ash, pearl ash).
10. Chlorimetry (bleaching powders).
11. Copper ore (Cu).
12. Zinc ore (Zn): by both gravimetric and volumetric methods.

Quantitative Analysis.—Conference. (1)

Physics.—Heat, electricity and magnetism. Lectures and recitations. (3) Mechanics, heat. Laboratory. (1)

English.—English literature. Essays. (2)

SECOND TERM.

Physics.—Electricity and magnetism, light, sound. Lectures and recitations. (3) Laboratory. (1)

Quantitative Analysis.—Fresenius's Quantitative Analysis. (6) The following analyses are executed by the student:

13. Lead ore (Pb, S).
14. Silver coin (Au, Pb, Ag, Cu).
15. Spiegeleisen (Mn): by both gravimetric and volumetric methods.
16. Copper alloys (complete analysis).
17. Ilmenite (TiO_2).
18. Iron ore (complete analysis).
19. Limestone (complete analysis).
20. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).
21. Slag (complete analysis).

Quantitative Analysis.—Conference. (1)

Chemistry.—Remsen. Advanced course. (3)

English.—English prose literature. Essays. (2)

JUNIOR CLASS.

FIRST TERM.

Toxicology.—Lectures. (2)

Quantitative Analysis.—Fresenius's Quantitative Analysis. (5) The following analyses are executed by the student:

22. Guano (NH_3, P_2O_5, H_2O).
23. Clay (complete analysis).
24. Manganese ore (MnO_2).
25. Mineral water (complete analysis).
26. Pig iron (complete analysis).
27. Nickel ore (Ni, Co).
28. Carbon in steel (colorimetric).
29. Gas analysis.

Quantitative Analysis.—Conference. (1)

Organic Chemistry.—Lectures and recitations. (4)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Economics.—Elementary economics. (1)

English.—English and American Orators. (1)

SECOND TERM.

Organic Chemistry.—Laboratory. (6)

Organic Chemistry.—Conference. (1)

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (5)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. E. S. Dana. (3)

Blowpipe Analysis. — Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Economics.—Economic Problems. (1)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of copper, lead, silver, gold, etc. (4)

Assaying.—Including the assay by the dry method of gold, silver, antimony, lead, iron, and tin ores, coal, gold and silver bullion, and rich lead. Ricketts. (3)

Industrial Chemistry.—Laboratory. (3)

Geology.—Williams's Lithology, with practical exercises in determining rocks. (3)

Microscopy.—Laboratory. (2).

Blowpipe Analysis.—Practice. (1)

Preparation of Thesis.

SECOND TERM.

Industrial Chemistry.—Lectures. (3)

Industrial Analysis.—Laboratory. (3)

Industrial Analysis.—Conference. (1)

Agricultural Chemistry.—Laboratory. (1)

Sanitary Chemistry.—Laboratory. (1)

Geology.—Historic and dynamic geology. Lectures. LeConte. (3)

Philosophy of Religion.—Lectures. (1)

Preparation of Thesis. (4)

PHYSICAL CULTURE.

The Gymnasium is open morning, afternoon, and evening; in all, 45 hours a week. Exercise in it is required of all students who are fitted to take it. Class drill with the Instructor and individual exercise are prescribed.

GRADUATING THESES.

Every student is required to present a thesis upon some topic connected with the course from which he is to graduate, as a necessary portion of the exercises for his final examination for a diploma. These theses are accompanied by drawings and diagrams, whenever the subjects need such illustration. The originals will be kept by the University, as a part of the student's record, for future reference; but a copy may be retained by the student, and be published, permission being first obtained from the President.

DIPLOMAS AND CERTIFICATES.

The Diploma is given only to those who have passed all the examinations in a regular course and is signed by the Secretary of the Board of Trustees and by the Faculty of the University. For all the partial courses a certificate is given, signed by the Secretary of the Faculty, and showing what the student has accomplished.

GRADUATE STUDENTS.

Graduate students wishing to remain a year or more and pursue a course of study as candidates for another Degree may do so with the sanction of the Faculty. Those wishing to take *special* courses of study will be afforded every facility for so doing.

GRADUATE DEGREES.

M. A.

The Faculty will recommend for the Degree of Master of Arts any candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Arts, shall pursue, for at least one year at this University, or two years elsewhere, a course of liberal study prescribed by the Faculty in at least two departments (under at least two professors), pass a thorough examination in the same, and present a satisfactory Thesis.

M. S.

The Faculty will recommend for the Degree of Master of Science any candidate, otherwise properly qualified, who, after taking at this University any Degree in the School of Technology, shall pursue, for at least one year at this University, a course of study prescribed by the Faculty in at least two departments (under at least two professors), pass a thorough examination in the same and present a satisfactory Thesis. Graduates of the Latin-Scientific Course, or of that of Science and Letters, are permitted to study *in absentia* for the degree of M.S., subject to the same restrictions as those prescribed for candidates for the degree of M.A.

The Theses presented by candidates for Graduate Degrees are retained by the University.

Applicants for either of these degrees will be required to complete the prescribed work within the allotted time. Special action of the Faculty is required for any extension of time.

THE UNIVERSITY LIBRARY.

The Library building was erected by the Founder of the University in 1877, at a cost of $100,000, as a memorial of his daughter, Mrs. Lucy Packer Linderman, and during the same year more than $20,000 were contributed by her family and friends as a memorial fund for the purchase of books. By the will of the Founder of the University a fund of $500,000 has been given for the permanent endowment of the library.

The building is semi-circular in plan, with a handsome façade in the Venetian style of architecture. It is constructed of Potsdam sandstone with granite ornamentation. In the interior, the center is occupied as a reading space, fifty by forty feet, from which radiate the book cases, extending from floor to ceiling; two galleries affording access to the upper cases. Shelf room is now provided for one hundred and sixty thousand volumes. The building is thoroughly fireproof, well lighted, and heated by steam.

Ninety-seven thousand volumes are now upon the shelves, including many extremely valuable works. The list of periodicals numbers about two hundred and fifty, embracing as far as possible all departments of knowledge.

The Library is conducted strictly for consultation, and is open to the use of the public; both of which conditions are in accord with the terms of the gift.

REGULATIONS OF THE LEHIGH UNIVERSITY LIBRARY.

I. The Library is open every day, except Sundays and Legal Holidays, from 8 A.M. until 10 P.M., and on Sundays for the students and others connected with the University from 1:30 P.M. until 9:30 P.M.

II. Admission is free to all persons over 16 years of age.

III. Readers are required to write their names and addresses in the Daily Register of the Library. They also write the name of the book desired upon a Library Card, with their signatures, and present the same to the Director's Clerk, who supplies the book, retaining the card as a receipt. Before leaving the Library, readers return their books to the clerk, and receive their cards.

IV. The University Professors and Instructors, only, are allowed to take books from the Library Building.

V. No person is allowed to enter the alcoves, or remove any book from the shelves, without permission of the Director.

VI. Readers wishing to consult the more valuable illustrated works make special application for that purpose.

VII. In taking notes, pencils, and not pen and ink, are to be used.

VIII. Audible conversation and the use of tobacco are strictly forbidden in any part of the Library.

IX. Any person not conforming to these Regulations will be denied the privilege of the Library.

X. Any person who defaces, in any way, any book, magazine or paper, or the furniture, or any portion of the building, in addition to being deprived of the privileges of the Library, will be prosecuted according to law.

THE ECKLEY B. COXE MEMORIAL LIBRARY.

In memory of the Honorable Eckley B. Coxe, who was for many years a Trustee of the University and who was profoundly interested in its welfare, Mrs. Coxe has presented to the University his technical library, consisting of 7727 volumes, together with 3429 pamphlets. As the working library of a man who was remarkable as well for the breadth of his culture as for the extent and thoroughness of his acquaintance with the whole field of applied science, this addition to the resources of the University possesses the greatest value for all professional students.

OBSERVATORY.

By the liberality of Robert H. Sayre, Esq., one of the Trustees of the University, an astronomical observatory was erected on the University grounds, and placed under the charge of the Professor of Mathematics and Astronomy.

In the dome of the observatory is mounted an equatorial telescope, of six inches aperture, by Alvin Clark & Sons. The west wing contains a superior sidereal clock, by Wm. Bond & Sons; a zenith telescope, by Blunt, and a field transit, by Stackpole. There is also a prismatic sextant, by Pistor & Martins.

Students in practical astronomy receive instruction in the use of the instruments and in actual observation.

The land upon which the Observatory stands, consisting of seven acres adjoining the original grant, was presented to the University by Charles Brodhead, Esq., of Bethlehem.

THE UNIVERSITY MUSEUM.

In addition to the large collection illustrating all branches of Industrial Chemistry, the Museum includes collections in Metallurgy, Geology, Zoölogy, and Archæology.

The Metallurgical Cabinet already includes specimens illustrating the various processes for obtaining the more common metals.

The Zoölogical Cabinet includes the Werner collection of nearly all the types of American birds with their nests and eggs, and the Packer collection of recent shells.

The Geological Cabinet numbers over ten thousand specimens and includes the Palæontological, Mineralogical, Petrographic, and Economic collections. The first contains good specimens of nearly all the common genera. The Mineralogical division includes the Keim and Roepper collections—the latter being especially complete and valuable from a crystallographic standpoint. The Petrographic division numbers several thousand specimens and, besides including numerous varieties of nearly all the rocks of the globe, contains a duplicate set from the collection of the Second Geological Survey of this State. The Economic division was formed and given by Dr. James P. Kimball, ex-Director of the Mint, and formerly Professor of Economic Geology.

The Cummings Archæological Cabinet numbers three thousand specimens and includes Dr. Stubbs's collection of Indian relics, weapons, and utensils.

SUMMER SCHOOL OF SURVEYING.

The regular course in topographic surveying for students in civil and mining engineering is given in the summer vacation between the Sophomore and Junior years. An optional course in Land Surveying is also offered at the same time, for which a fee of $15 is charged. These courses are open to a limited number of persons, not students at the University, who are qualified to pursue them, upon payment of the same fee. Application should be made to the professor of civil engineering before June 1st.

UNIVERSITY LECTURES.

From time to time during the University year, distinguished members of the various professions are invited to lecture before the student body upon those special subjects to which they have given particular attention and upon which they are authorities.

The following lectures were given in this course before the beginning of the present academic year:

Mr. Eckley B. Coxe, "Technical Education."

Dr. R. W. Raymond, "The Nature and Force of the Mineral Land Patents of the United States."

Mr. R. W. Davenport, "The Manufacture of Armor Plate."

Mr. E. D. Leavitt, "A Modern Mining Plant."

Professor W. T. Sedgwick, "Germs as Friends and Foes."

Dr. C. B. Dudley, "Lubrication."

Mr. C. E. Webster, "Inspection of Railroads."

Professor Charles McMillan, "The Purification of Sewage by Filtration through Coal Ashes."

Mr. H. F. J. Porter, "Modern Methods of Making Steel Forgings."

Col. H. G. Prout, "Railroad Accidents."

Mr. John Birkinbine, "Engineering on the Great Lakes."

Mr. W. B. Snow, "Mechanical Draft."

Mr. H. W. Raymond, "Warships Old and New."

Mr. Alfred Raymond, "Chartres Cathedral."

THE CHEMICAL AND NATURAL HISTORY SOCIETY OF THE LEHIGH UNIVERSITY.

This Society was organized in the Fall of 1871, as "The Chemical Society," but was afterwards expanded, as its present title indicates, and admits, by election, students from all departments of the University.

The collections of botanical and zoölogical specimens belonging to the Society are already important. During the past years persons have been sent to Texas and Brazil to collect specimens for these cabinets.

The Society has organized and maintained several courses of public scientific lectures.

THE ENGINEERING SOCIETY.

This Society was organized in 1873, and admits, by election, students in the Junior and Senior Classes. Its meetings are held fortnightly. At these, papers relating to engineering subjects are read and discussed. From 1885 to

1890 it issued quarterly five volumes of "The Journal of the Engineering Society," containing contributions by the members, alumni, and others. Many of the papers read before this society from 1890 to 1893 were published in "The Lehigh Quarterly."

The society includes in its membership students from all the engineering courses of the University. In addition to the general organization of the society, with fortnightly meetings as above stated, the representatives of the Civil and Mechanical Engineering courses form subordinate sections, with separate organizations and stated meetings, for the discussion of subjects of particular interest.

THE ELECTRICAL ENGINEERING SOCIETY

was organized in November, 1887. Its object is to supplement the regular work of the department by the study and discussion of electrical subjects.

THE AGORA AND THE FORUM

are literary and debating societies which meet semimonthly. The Agora is the older society and was formerly restricted in its membership to students in the School of General Literature, but in 1893 it was thrown open to all students; and shortly afterward the Forum was organized. These societies have proved of great advantage to their members in the development of concise and logical thinking, in the promotion of ease before an audience, and in the acquirement of experience in parliamentary methods. Through these societies the University is represented in the Pennsylvania Inter-collegiate Oratorical Union. An annual contest in debate is held with representatives of the literary societies of Lafayette College. The societies have justified their existence by the great increase in the amount of attention given, not only to training in oratory and debate, but also to those subjects of the day which are constantly discussed at their meetings.

THE MATHEMATICAL CLUB.

This club was organized in February, 1895. Its members are students in the Junior and Senior classes. Its object is to continue the study of higher mathematics after having completed the mathematical course of the University. It holds frequent meetings at which papers are read and discussed by its members.

THE LEHIGH UNIVERSITY CHRISTIAN ASSOCIATION.

This is a voluntary organization of the students for the promotion of the religious, moral, and social life of the University. It was organized April 18, 1890, and on Oct. 11, 1890, united itself with the Intercollegiate Young Men's Christian Association. The movement is distinctly for and by students, all the officers being chosen from the student-body. Those connected with Evangelical churches of whatever creed are eligible to *active membership; associate membership* may be claimed by men of good moral standing who are not members of churches. The association is continually growing, and is extending a marked influence for good among the men.

FOUNDER'S DAY.

On the second Thursday of October of each year, Commemorative Exercises are held in honor of the Founder of the University. On Thursday, October 13, 1898, the nineteenth Founder's Day was celebrated. An address was delivered by Professor Langdon C. Stewardson, Chaplain of the University. His subject was "Origins and Destiny."

UNIVERSITY SERMON.

This sermon is preached on the Sunday before University Day.

The Rt. Rev. Ethelbert Talbot, D.D., LL.D., Bishop of Central Pennsylvania, was the preacher on Sunday, June 12, 1898, in the Packer Memorial Church.

THESES.

Theses on the following subjects were prepared by candidates for degrees in 1898:

FOR THE DEGREE OF MASTER OF SCIENCE.

BARRY MAC NUTT, E.E., Bethlehem.
A Study of Galvanic Polarization.

HENRY STORRS WEBB, B.S. (M.I.T.), South Bethlehem.
Hysteresis Loss in Soft Iron for Small Ranges of Induction.

FOR THE DEGREE OF ENGINEER OF MINES.

JOHN BOYT, B.S., Adamsford.
Haulage by Compressed Air, with a View of the High Pressure System at Alaska Colliery.

THOMAS CEDWYN THOMAS, B.S., Wilkes-Barre.
The Efficiency of Grates for Burning Small Sizes of Anthracite Coal.

FOR THE DEGREE OF BACHELOR OF ARTS.

ALANSON QUIGLEY BAILEY, Paterson, N.J.
Socrates, as Portrayed by Xenophon and Plato.

JACOB B. KRAUSE, South Bethlehem.
The Roman Senate.

MARTIN SHAAFF STOCKETT, Pottsville.
The Kansas-Nebraska Struggle.

CHARLES EDWARD WEBSTER, JR., South Bethlehem.
The Place of Euripides in the History of the Dramatic Art.

FOR THE DEGREE OF CIVIL ENGINEER.

HARRY LEIGH ADAMS, Washington, D. C.
Investigation of the Water Supply System of Bethlehem, Pa.

ALEJANDRO BARRIENTOS, Santiago de Cuba, Cuba.
Design for a Stone Arch Bridge of 60 feet Span.

WILLIAM ADAM DEHM, New Britain, Conn.
The Alignment and Grade of the Lehigh & Lackawanna Railroad between Bethlehem and Bath, Pa.

CHARLES MEIRS DENISE, B.S. (Rutgers), Allentown, N.J.
Investigation of the Sewerage System of Plainfield, N.J.

EDGAR RAYMOND FRISBY, Washington, D.C.
The Economic Depth and Limiting Span of the Pratt Truss.

FRANCISCO MARTINEZ GALLARDO, M.E., Guadalajara, Mex.
The Power and Efficiency of the Pumping Machinery of the Water Works at Bethlehem, Pa.

FRANK HAMMOND GUNSOLUS, Tipton, Iowa.
The Four-Point Problem in Geodetic Triangulation.

FRANK NORMAN KNEAS, Norristown.
Design for a Lattice Bridge and Approaches at Norristown, Pa.

JOHN BROWN LINDSEY, JR., Frankfort, Ky.
The Stresses in Gun Tubes and Hoops.

CLARENCE ALBERT LOOMIS, Plainfield, N. J.
Review of the Water Supply System of Plainfield, N. J.

JOSÉ ARISTIDES DE OBALDIA, Panama, Colombia.
Review of Water Powers on the Lehigh Canal and Monocacy Creek near Bethlehem, Pa.

HOWARD CHARLES PADDOCK, East Berlin, Conn.
Design for a Railroad Train-shed with Three-hinged Arches.

FREDERICK ALLEN PERLEY, Williamsport.
The Backwater Problem on the Proposed Nicaragua Canal.

VICTOR CLINTON RECORDS, Laurel, Del.
Plan and Estimate for a Water Supply for Smyrna, Del.

PERCY LAWRENCE REED, New Bedford, Mass.
Review of the Trestles and Culverts on the Lehigh & Lackawanna R. R. between Bethlehem and Bath, Pa.

Daniel Franklin B. Shepp, Tamaqua.
The Sanitary Condition of the U. S. Military Camps at Falls Church, Va., Dunn Loring, Va., and Middletown, Pa.

Lawrence Wooden, Hampstead, Md.
Plan and Estimate for the Water Supply of Reisterstown, Md.

Harry Statten Zimmerman, State Line.
The Stresses in Beams and Bridges Due to the Velocity of the Live Load.

FOR THE DEGREE OF MECHANICAL ENGINEER.

Junius Ballard, Louisburg, N. C.
When is it Economical for a Railroad to Buy Locomotive Parts ?

Henry David Bishop, Bethlehem.
The Progress in the Economical Production of Superheated Steam.

Horatio Francis Brown, Baltimore, Md.
Modern Railway-signal Practice.

George Davies, Catasauqua.
Design for an Electric Traveling Crane.

John Jacob Eckfeldt, Conshohocken.
Discussion of the Diesel Motor.

Linden Erle Edgar, Wilkes-Barre.
Investigation of Car Haulage about Anthracite Coal Mines.

Willard Boyer Fuller, Catasauqua.
Design for a Car Wheel Plant.

Wentworth Greene Hare, Philadelphia.
Experiments in Gas Engine Running.

Edward Darling Hillman, Wilkes-Barre.
An Underground System for Rapidly Delivering Mail, Parcels, etc., in New York City.

Basil George Kodjbanoff, Monastir, Macedonia.
Mechanical Contrivances Used in the Construction of East River Tunnel.

LEE HOLMES MARSHALL, Pittsburg.
The Erection of an Electric Elevator for Passenger Service.

CARROLL WINSTON QUARRIER, Charleston, W. Va.
The Experimental Determination of the Moments of Inertia of the Straight Line Engine.

BENJAMIN DEWITT RIEGEL, Riegelsville, N.J.
The Comparative Efficiency of Small Coal Determined by Special Tests.

D'ARCY WENTWORTH ROPER, Petersburg, Va.
The Design of an Electric Elevator for the Warehouse of Roper & Co., Petersburg, Va.

LEWIS CHESTON STARKEY, Bustleton.
The Temperature-Entropy-Curve and its Application to Engineering.

E. HARRISON SYMINGTON, Baltimore, Md.
Discussion of Jet Air Turbine Applied to Portable Differential Drill.

EDWARD HILEMAN WARING, Plainfield, N.J.
Determination of Power Needed to Drive a Vessel at a Given Speed.

CHARLES BARTLETT WARREN, Westfield, Mass.
A Comparison of Belt and Electric Transmission in a Textile Mill.

THEODORE BENJAMIN WOOD, Chambersburg.
Design of a Pulley Moulding Machine.

WARREN WORTHINGTON, Rushland.
Are High Speed Pumps Feasible ?

FOR THE DEGREE OF BACHELOR OF SCIENCE

(IN METALLURGY).

HENRY THEODORE BORHEK, Bethlehem.
An Investigation of the Variations in Composition of Different Flushes of Blast Furnace Cinder in One Day's Working of the Furnace.

David Hope Childs, Towanda.
A Description of the Russell Process for the Lixiviation of Silver Ores, with a Discussion of the Applicability of this Process to the Treatment of the Ores of Parral, Chihuahua, Mexico.

José Maria Garza Galán, Jr., Saltillo, Mex.
The Extraction of Silver by the Patio Process at Parral, Chihuahua, Mexico.

Rafael Francisco Sanchez, Gibara, Cuba.
Design of a Copper Smelting Plant for Treating the Ores of the La Palma Mine, Province of Santiago, Cuba.

FOR THE DEGREE OF ELECTRICAL ENGINEER.

Paul Bucher (with H. J. Horn), Lebanon.
Construction and Test of an Electrolytic Generator for Oxygen and Hydrogen.

Herbert Myron Daggett, Jr., Elmira, N.Y.
Design of a Power Station for the New Orange Electric Railway.

Edgar Davis Edmonston, Washington, D.C.
Plans for the Utilization of the Power of the Great Falls of the Potomac.

Robert Edward Lee George, Ellicott City, Md.
Construction and Tests of Electrodynamometers.

William Gratz (with H. C. Schwecke), Carmel, N.J.
Efficiency Tests of the Bichromate Battery.

Raymond Hazel (with T. H. Lawrence), Cressona.
Plans and Specifications for a Municipal Lighting Plant.

Henry B. Hershey (with S. A. Yorks, Jr.), Columbia.
Practical Tests of a Silk Mill Lighting Plant.

Herbert Henninger Hess, Hellertown.
Plans for an Electric Railway from Hellertown to Coopersburg.

Harold John Horn (with P. Bucher), South Bethlehem.
Construction and Test of an Electrolytic Generator for Oxygen and Hydrogen.

Leonard Sherman Horner, Marshall, Va.
Design of an Isolated Lighting Plant.

Thomas H. Lawrence (with R. Hazel), Danville.
Plans and Specifications for a Municipal Lighting Plant.

Charles F. Moritz (with L. Watts, Jr.), South Bethlehem.
Efficiency Tests of a Storage Battery.

Henry Cord Schwecke (with W. Gratz), Charleston, S.C.
Efficiency Tests of the Bichromate Battery.

Levi Watts, Jr. (with C. F. Moritz), Terre Hill.
Efficiency Tests of a Storage Battery.

Samuel A. Yorks, Jr. (with H. B. Hershey), Danville.
Practical Tests of a Silk Mill Lighting Plant.

FOR THE DEGREE OF ANALYTICAL CHEMIST.

Daniel John Broughal, South Bethlehem.
India Rubber and its Adulterations.

John O'Reilly, South Bethlehem.
Glass and its Solubility in Water and Chemicals.

B. Roland Smoot, Provo City, Utah.
Acetylene, its Formation and Properties.

Harry Bernard Zimmele, New York City.
Hydrogen Peroxide, its Manufacture, Properties, and Uses.

UNIVERSITY DAY.

This day is the last of the academic year, and falls in 1899 on the second Wednesday in June. On this day orations are delivered by members of the graduating class, and degrees are conferred.

EXERCISES ON JUNE 15, 1898.

MUSIC.

READING OF SCRIPTURE AND PRAYER.

MUSIC.

Salutatory Oration.—"The Value of Ideals."
EDGAR RAYMOND FRISBY.

MUSIC.

Oration.—"The Nicaragua Canal."
FRANK NORMAN KNEAS.

Oration.—"Advancement Due to the Engineer."
D'ARCY WENTWORTH ROPER.

MUSIC.

Alumni Address.—"Conditions of Professional Success."
FRANK PERLEY HOWE, A.B., E.M.,
Class of 1878.

MUSIC.

Valedictory Oration.—"Modern Warfare."
HAROLD JOHN HORN.

MUSIC.

Award of the Wilbur Scholarship to
ALBERT WILLIAM BAYARD, of Washington, D. C.,
first in rank in the Sophomore Class;
with honorable mention of
LOUIS ORTNER, of Drifton.

The Price Prize for English Composition, open to members of the Sophomore Class, was awarded to

ALBERT WILLIAM BAYARD, of Washington, D.C.,
with honorable mention of
GEORGE WILLIAM BARAGER, of Hazleton, and
JOSEPH STAUFFER SHULTZ, of Washington Boro.

The Wilbur Prizes, for excellence in the studies of Freshman year, were awarded as follows:

In Mathematics, to
THOMAS MERCER GIRDLER, of Jeffersonville, Ind., and
HENRY JARVIS MOORE, of Gill, Mass.

In German, to
JOHN WALLACE SHEAFFER, of Fleetwood.

In French, to
Ernesto Franco, of Quito, Ecuador.

In English, to
Edwin Benton Wilkinson, of Williamsport, and
Lewis Alfred Freudenberger, of Bethlehem.

In Freehand Drawing, to
John Joseph Nolan, of Carbondale.

In General Chemistry, to
Newton Wayne Buch, of Lancaster.

Degrees were then conferred by the President of the University upon the candidates whose names appear in the Thesis List, as given above.

THE WILBUR SCHOLARSHIP.

This Scholarship was founded in 1872 by E. P. Wilbur, Esq., of South Bethlehem, and is the sum of $200 awarded annually to the student in the Sophomore Class having the best record.

THE ALUMNI SCHOLARSHIP FUND.

The Alumni Association of the University has established a Scholarship Fund, for the assistance of worthy students. Such assistance is to be given in the form of loans, secured by notes properly endorsed, subject to the following conditions:

1. That loans from this fund shall be made only to students in need of such help.

2. That help in this form shall not be given during the first year of any student's course ; he must without this aid have gone through one year, and must be prepared to start the second year free from all conditions.

3. That help in this form shall not be continued to a student who shall at any time during his course carry any condition over eight weeks beyond the date of the examination in which he failed.

Subject only to the above conditions the disposal of the fund shall until otherwise directed be in the hands of the President of the University.

THE HENRY S. HAINES MEMORIAL SCHOLARSHIP.

Mrs. Henry S. Haines, of Savannah, Ga., established in 1889 a scholarship of the annual value of $200, which is to be devoted to the support at the Lehigh University, throughout his scholastic career, of one student in the School of Mechanical Engineering.

THE FRED. MERCUR MEMORIAL FUND SCHOLARSHIPS.

Friends of the late Frederick Mercur, desiring to establish a memorial of their friendship and esteem, and to perpetuate his memory, have contributed and placed in the hands of the Trustees a fund, to be called "The Fred. Mercur Memorial Fund," sufficient in amount to insure the award of several scholarships for free tuition in the University.

THE ECKLEY B. COXE MEMORIAL FUND.

In memory of the late Eckley B. Coxe, trustee of the University, Mrs. Coxe has established a Fund, amounting to $20,000, the interest of which is to be used, under the direction of the Trustees of the University, and subject to such regulations as they may adopt, for the assistance of students who without such aid would not be able to meet the cost of living as students of the University.

WILBUR PRIZES.

By the generosity of E. P. Wilbur, Esq., a fund has been established, yielding an annual income of $100, for distribution in prizes as the Faculty shall determine.

THE PRICE PRIZE FOR ENGLISH COMPOSITION.

Dr. Henry R. Price, an Alumnus and Trustee of the University, established in 1898 an annual prize of the value of $25, to be awarded in June to that member of the Sopho more class who shall write the best essay on a topic in English Literature assigned by the head of the department of English not later than the beginning of the Second Term in each year.

In estimating the value of all such essays the greatest stress will be laid upon clearness of thought and idiomatic force of expression; and, in the judgment of the examiner, while looking for correctness of thought put into clear and forcible English, expression will take precedence of ideas. For this specific end, weight will be given to the form rather than to the matter presented.

Competitors must signify their intent not later than the first of May.

The subject for the prize essay in June, 1899, will be: "Tennyson's Dramatic Works."

ALUMNI PRIZES FOR ORATORY.

The "Alumni Association of the Lehigh University" established in 1882 an annual sum of Fifty Dollars, to be distributed in prizes for excellence in Oratory, subject to the following

REGULATIONS.

1. The Contest shall be held on the 22d day of February, or on the day designated by the University to commemorate the birthday of Washington.

2. There shall be a first prize of $25, a second of $15, and a third of $10.

3. To entitle one to be a competitor he must be a member of the Junior Class, taking a regular course.

4. Subjects for the orations shall be announced at the beginning of the first term of every year, and upon one of these each competitor shall write an oration not to exceed 1200 words, taking about eight minutes in delivery.

5. Each oration shall bear upon its first page a fictitious name or motto, and shall be accompanied by a sealed envelope, which shall be superscribed with the same name or motto, and an address by which it may be reclaimed.

The envelope shall contain the real name and address of the writer, with the declaration that the oration is his own original work. The examiner, having adopted a standard of excellence, may reject any or all of the orations presented which do not attain to this standard; of such as do —should they be sufficient in number—the best six shall be chosen, and their envelopes opened. The others shall be returned to the address given with their envelopes unopened.

6. The Executive Committee of the Alumni Association, or a committee of not fewer than three to be appointed by them, shall hear the competitors whose orations shall have been approved, and the awards shall be made by a majority of these judges.

7. In awarding the prizes the judges shall consider both the literary merits and the delivery of each oration.

8. These rules are subject to amendment by the Faculty.

The annual contest in Oratory for the Alumni Prizes was held on February 22, 1898, with the following competitors:

Robert Farnham, jr., of Washington, D. C.
William Lathrop Meaker, of Bethlehem.
George Loomis Robinson, of Elmira, N. Y.
Henry Anderson Wilcox, of West Granby, Conn.

The First Prize was awarded to Henry Anderson Wilcox; the Second to George Loomis Robinson; the Third to William Lathrop Meaker.

ENTRANCE EXAMINATION PAPERS.

Used for Examination in 1898.

I.—ENGLISH.

1. Define Rhetoric. Is it a science or an art? Compare it, in this respect, with grammar and logic.

2. What is the province of Style; its most essential element? Define Style. What is individuality in Style?

3. Define Diction. What cautions are to be observed about "present use" of words? About Latin or Saxon words? About provincial, technical, and archaic words?

4. What are figures of speech? When is their use appropriate? What figures promote clearness and concreteness? What is an abstract idea?

5. State the essentials of a good definition? Define any three common nouns on that plan. Define a *rule* and a *concrete example.*

6. State the rhetorical value of a Simile and a Metaphor. How do they differ? Upon what relation is Metonymy based? What are the natural defects of Allegory?

7. Meanings of Allegory, Personification, Antithesis; upon what principle is the latter based? What are a climax and an anti-climax? Is the latter ever allowable?

8. What is meant by Suspension? What is a balanced sentence; a loose sentence: a periodic sentence? What are synonyms, and on what principle are they to be distinguished and used? What are homonyms?

9 and 10. Write a short piece of descriptive prose of not more than 200 words on one of the following subjects: 1. The Plot of Macbeth. 2. The College for Women, in "The Princess."

II.—U. S. HISTORY AND CONSTITUTION.

1. Who proposed and who seconded the Compromise of 1850? What were its conditions?

2. Give the leading events, domestic and foreign, of the two terms of President Monroe's administration.

3. What were the provisions of the Fugitive Slave Law? What was its worst provision? What its effect?

4. What were the four parties at the Presidential election of 1860, and who were their candidates?

5. What were the great battles of 1862 in the East? In the West? What were the results of the year's operations?

6. What dispute was ended by the Treaty of Washington in 1871? What were the provisions of the treaty and how were they carried out?

7. What power over taxes is given to Congress? What power in relation to commerce?

8. What is the XIVth Amendment, and who has the power to enforce it?

9. What constitutes treason against the United States?

10. How was the President's election after Gen. Grant's second term settled?

III.—GEOMETRY.

1. *a.* Define Solid, Curved Surface, Corollary, Scholium, Polygon. *b.* Name the different triangles and give figure for each one.

2. The three perpendiculars from the vertices of a triangle to the opposite sides meet in the same point.

3. An inscribed angle is measured by half its intercepted arc.

4. Prob. *a.* To find the mean proportional to two given lines. *b.* To draw a tangent to a circle from a point outside.

5. Give a proof of the area of a trapezoid.

6. A circle has an area of 22 sq. ft. Find the number of centimeters in the radius of a circle having double this area.

7. *a.* Define Diedral Angle, Prism, Tetraedron, Ratio of Similitude, Polar Triangles. *b.* Show how to find the center of a given material sphere.

8. What is the measure of the angle of two great circles? Give proof.

9. Prove, a triangular pyramid is one-third of a triangular prism of the same base and altitude.

10. Given a pyramid whose base is 17 sq. ft., altitude 8 ft. At what distance from the vertex must a plane, parallel to the base, be passed in order to divide the pyramid into two equivalent solids?

IV.—ALGEBRA.

1. Simplify $\frac{x^2-y^2}{xy} - \frac{xy-y^2}{xy-x^2}$; also, $a^2 - \cfrac{1}{\cfrac{a^3-1}{a+\cfrac{1}{a+1}}}$

2. Express in simplest form $\sqrt[2]{27\,a^3\,b^5}$. Express as a whole number $(27)^{\frac{2}{3}} + (16)^{\frac{3}{4}} - \frac{2}{8^{-\frac{2}{3}}} + \frac{\sqrt[5]{2}}{(4)^{-\frac{2}{5}}}$.

3. Find L. C. M. of x^3+y^3, $3x^2+2xy-y^2$ and $x^3-x^2y+xy^2$.

4. Factor, $3x^3+6x^2-189x$; $x^{16}-y^{16}$; $x^2-\frac{x^2-1}{x+1}$.

5. Solve $\begin{cases} y = \frac{x+a}{2} + \frac{b}{3} \\ x = \frac{y+b}{2} + \frac{a}{3} \end{cases}$; also $\frac{x+3}{x-1} + \frac{x-4}{x-6} = 2$.

6. Solve $\sqrt{x+5} + \sqrt{3x+4} = \sqrt{12x+1}$.

7. How much are pears a gross when 12 more for a dollar lowers the price 5 cents a dozen?

8. Find a quantity such that when it is subtracted from each of the quantities a, b, c, the remainders are in continued proportion.

9. Find the divisor when $(4a^2 + 7ab + 5b^2)^2$ is the dividend, $8(a+2b)^2$ the quotient, and $b^2(9a + 11b)^2$ the remainder.

10. A lawn 50 ft. long and 34 ft. broad has a path of uniform width around it; if the area of the path is 55 sq. meters find its width in feet.

V.—PHYSICS.

1. A moving train on a straight, level track is acted upon by two forces, namely, the pull of the locomotive and the drag due to track and wind. Which of these forces is the larger while the train is gaining speed? Which is the larger while the train is losing speed? What is their relative value while the speed of the train is neither increasing nor decreasing? Justify your answer in each case by statements of Newton's Laws of Motion.

2. Considerable work has to be done in riding a bicycle, and in the doing of this work there are two distinct cases in which a rider feels a certain advantage.

(a) When a rider is about to climb a hill he feels it to be greatly to his advantage if he has considerable speed to start with. What is this *advantage of speed* called in mechanics?

(b) When a rider is on top of a hill he feels a certain advantage. What is this *advantage of position* called in mechanics?

3. State Archimedes's principle. What is meant by the Specific Gravity of a substance? Give a full explanation of a method for finding the specific gravity of a solid.

4. A pump with a piston one inch in diameter is used to pump water into a cylinder in which there is a piston fifteen

inches in diameter. A force of 5000 pounds acts upon the pump piston; calculate the force acting on the fifteen inch piston.

5. Why are the temperatures of freezing water and of boiling water (at standard pressure) taken as reference or standard temperatures in Thermometry? Given an ordinary thermometer without graduations of any kind, explain in detail the method of making the graduations.

6. A pound of coal when burned gives off enough heat to raise the temperature of 1000 pounds of water from 35°F. to 46°F. Find the amount of ice which one pound of coal wiil melt and the amount of water at the boiling point which one pound of coal will vaporize. In this calculation consider that to melt one pound of ice requires as much heat as would raise the temperature of 10 pounds of water 14.6 Fahrenheit degrees, and that to vaporize one pound of water at the boiling point requires as much heat as would raise the temperature of 10 pounds of water 96 Fahrenheit degrees.

7. What is the name of the process by means of which heat is transmitted from the sun to the earth? Give other examples of the same process. By what means (mainly) is heat distributed throughout a vessel of water on a stove? What is the name of this process? Give other examples of it. What is the name of the process by means of which heat is carried along a metal rod? Name several substances in the order of the facility with which they transmit heat by this last process.

8. The temperatures of boiling water on a high mountain, at sea level, and in a boiler which furnishes steam for a steam engine, are different. Which is the hottest and which the coolest? What is it that causes the boiling point of water to be different in these different cases?

9. Describe the three fundamental phenomena of the electric current and describe practical applications of electricity exemplifying each.

10. An iron rod is wound with insulated wire. What is the effect on the rod when an electric current is sent

through the wire? What is such an arrangement called? Name several practical appliances of each of which the above is an essential part.

11. An ordinary electric bell continues to ring so long as the push-button is depressed. Make a diagram showing the electrical connections of such a bell, including push-button and battery, and explain the vibratory action of the bell.

12. Draw a diagram showing the electrical connections of sounder, local battery, relay, and key, at an ordinary telegraph station, and explain the action and use of the relay.

13. What is the physical difference between a noise and a musical tone? Musical tones may differ in loudness, in pitch, and in timbre or quality; explain the physical basis of each.

VI.—GERMAN.

1. Decline ,,jenes schöne Haus," ,,die kleine Rose", ,,welcher Knabe", in singular and plural.

2. Give genitive and nominative plural, gender, and meaning of the following nouns:

Schiff, Ring, Mutter, Pferd, Mädchen, Land, Stadt, Zeit.

3. Write out synopsis (third person singular) of ,,reden", ,,anziehen".

4. Give third person Singular, Present, Imperfect, and Perfect Tenses (Indic. and Subj.) of following verbs: reiten, raten, bleiben, aussteigen, thun, geschehen, stossen, schwingen.

5. Give the peculiarities in the conjugation of auxiliary verbs of mood; are both auxiliaries used in the compound tenses of the past?

6. What is the principal difference in the use of the Relative Pronoun in English and in German? Give examples.

Translate into German:

1. When I arrived yesterday it was very dark, to-day I did not arrive so late.

2. Has it been warm to-day? No, it has been cooler than yesterday.

3. He has been seen in the park by the sons of the King

4. She did not work willingly[1] but she was compelled[2] to work the whole day.

5. That is the lady who has the pretty daughters I saw on the street.

6. If I had known of his father's death, I would have written him.

[1] gern. [2] müssen.

Translate into English:

Ich bin in Philadelphia geboren. Meine Eltern sind beide Amerikaner. Ich habe noch einen Bruder und zwei Schwestern, welche sämtlich älter sind als ich. Von meinem sechsten bis zum achten Jahre besuchte ich die William-Penn-Schule meiner Vaterstadt. Im Jahre 1887 zog ich mit meinen Eltern und Geschwistern nach der Bundeshauptstadt Washington, wo mein Vater eine Regierungsanstellung[1] im Patent-Amt erhalten hatte. Bis zum Juni 1894 besuchte ich die Webster-Schule, eine der öffentlichen Schulen im District Columbia, und im September desselben Jahres trat ich als Schüler in die Central-Hochschule in Washington ein. Ich erwählte[2] den akademischen Kursus, weil ich ein grosses Interesse für das Studium der Sprachen fühlte. In meinen ersten beiden Jahren in der Hochschule beschäftigte ich mich hauptsächlich mit englischer Sprache und Litteratur, mit Lateinisch und Griechisch, sowie mit römischer und griechischer Geschichte. Während des dritten und vierten Jahres wurde Deutsch mein Lieblingsstudium.[3]

Es ist der Wunsch meiner Eltern, dass ich meine Sprachstudien die nächsten vier Jahre in Yale College fortsetzen[4] und dann noch ein paar Jahre eine deutsche Universität besuchen soll. Meine Absicht ist, Sprachlehrer an einer höheren Schule meines Vaterlandes zu werden.

[1] Government position. [2] to choose. [3] favorite study. [4] to continue.

VII.—FRENCH.

1. Give the relative pronouns and how they are used; state principal difference in the use of the relative pronoun in French and in English, and give example.

2. Give meaning, and form feminine of the following adjectives:

Honnête, bon, beau, malheureux, vieux, blanc, petit, fou.

Give meaning and form plural of the following nouns:

Chapeau, cheval, ciel, oeil, fils, nez, bijou, fou.

3. Give principal parts of the following verbs:

Savoir, écrire, tenir, pouvoir, lire, partir, devoir, falloir.

4. Give first and third person, Singl. and Plural, Present, Perfect and Preterite Tenses (Indic. and Subj.) of faire, aller, naître, suivre, mettre, venir.

5. When does the past participle in a compound tense agree with the subject? When with the object? and when does it remain unchanged? Give examples.

Translate into French:

1. Do not give it to him; give it to me.

2. Is the master not loved by every one?

3. He is hungry but he is too warm, and cannot eat anything.

4. At what hour was my father here yesterday? He told him he was ninety-two years old.

5. The trees are in the garden behind the house and the fruit is on the trees, and under the trees there is much shade.[1]

[1] ombre.

Interrompu au milieu de la délibération, Hadgi-Stavros fit à ses prisonnières un accueil[1] glacial. Il n'offrit pas même un verre d'eau à Mme Simons, et comme elle n'avait point déjeuné, elle fut sensible à cet oubli de [2]convenances. Je pris la parole au nom des Anglaises, et, en l'absence de Corfiote, le Roi fut bien forcé de m'accepter pour intermédiaire. Je lui dis, qu'après le désastre de la veille,[3] il serait content d'apprendre la détermination de Mme Simons; qu'elle avait résolu de payer dans le plus bref délai, sa rançon et la mienne ; que les [4]fonds seraient [5]versés le lendemain, soit à la banque d'Athènes, soit en tout autre lieu qu'il lui plairait de désigner, contre son reçu.

"Je suis bien aise, dit-il, que ces femmes aient renoncé à convoquer l'armée grecque à leur secours. Dites leur qu'on leur remettra, pour la seconde fois, tout ce qu'il faut pour écrire ; mais qu'elles n'abusent plus de ma confiance ! qu'elles ne m'attirent pas les soldats ici !

1 reception. 2 good manners. 3 eve. 4 money. 5 to pay over.

VIII.—LATIN.

I. GRAMMAR.

Decline *locus*, *lacus*, *lac*, *lex*, *deus*, *Anchises*, *respublica.*

Decline the following words in all three genders: the relative pronoun, *ipse*, *idem*, *tristior*, *nequam*, *liber*, *celer.*

Compare *idoneus*, *senex*, *prior*, *providus*, *acer*, *male.*

Give the ordinal numbers from fifth to fifteenth.

Give the following verb synopses : *aro* through the active voice in the third person singular ; *doceo* in second person in the passive ; *tego* in third person of the passive.

Inflect *soleo* complete in subjunctive mood.

Give all the participles of *hortor.*

Inflect *eo* in indicative complete, and *malo* in the subjunctive.

State the different ways of expressing purpose and give examples.

Give the different uses of the genitive case.

What are the various forms of the conditional sentence ?

II. CÆSAR.

Translate the following passages and answer the questions upon them :

1. (*Bk. I*, 45.) Multa ab Cæsare in eam sententiam dicta sunt, quare negotio desistere non posset, et neque suam

neque populi Romani consuetudinem pati, uti optime merentes socios desereret, neque se judicare, Galliam potius esse Ariovisti quam populi Romani. Bello superatos esse Arvernos et Rutenos ab Q. Fabio Maximo, quibus populus Romanus ignovisset neque in provinciam redegisset neque stipendium imposuisset. Quodsi antiquissimum quodque tempus spectari oporteret, populi Romani justissimum esse in Gallia imperium; si judicium senatus observari oporteret, liberam esse Galliam, quam bello victam suis legibus uti voluisse.

Write verbs in the moods and tenses of the Direct Discourse. Give syntax of *negotio*, *Ariovisti*, *bello*, *legibus*.

2. (*Bk. III*, 23.) Armis obsidibusque acceptis Crassus in fines Vocatium et Tarusatium profectus est. Tum vero barbari commoti, quod oppidum et natura loci et manu munitum paucis diebus, quibus eo ventum erat, expugnatum cognoverant, legatos quoquoversum demittere, conjurare, obsides inter se dare, copias parare coeperunt. Mittuntur etiam ad eas civitates legati, quae sunt citerioris Hispaniae finitimae Aquitaniae: inde auxilia ducesque arcessuntur.

III. Vergil.

Translate (*Aen. Bk. II*, *line* 705).

Dixerat ille : et jam per moenia clarior ignis
auditur, propiusque aestus incendia volvunt.
'Ergo age, care pater, cervici imponere nostrae ;
ipse subibo umeris, nec me labor iste gravabit :
quo res cumque cadent, unum et commune periclum,
una salus ambobus erit. Mihi parvus Iulus
sit comes, et longe servet vestigia conjunx :
vos, famuli, quae dicam, animis advertite vestris.

Give principal parts of the verbs. Write out the first two lines, marking the feet and the cæsura.

(*Aen. Bk. IV*, *line* 296.)

At regina dolos—quis fallere possit amantem ?
Praesensit, motusque excepit prima futuros,

omnia tuta timens. Eadem impia Fama furenti
detulit armari classem cursumque parari.
Saevit inops animi, totamque incensa per urbem
bacchatur, qualis commotis excita sacris
Thyias, ubi audito stimulant trieterica Baccho
orgia, nocturnusque vocat clamore Cithaeron.

IV.—CICERO.

(*In Catilinam*, *II*, 4.) Quod exspectavi, jam sum adsecutus, ut vos omnes factam esse aperte conjurationem contra rem publicam videretis: nisi vero si quis est qui Catilinae similis cum Catilina sentire non putet. Non est jam lenitati locus: severitatem res ipsa flagitat. Unum etiam nunc concedam: exeant, proficiscantur; ne patiantur desiderio sui Catilinam miserum tabescere. Demonstrabo iter: Aurelia via profectus est: si adcelerare volent, ad vesperam consequentur.

(*In Catilinam*, *IV*, 4.) Video adhuc duas esse sententias: unam D. Silani, qui censet eos, qui haec delere conati sunt, morte esse multandos; alteram C. Caesaris, qui mortis poenam removet, ceterorum suppliciorum omnis acerbitates amplectitur. Uterque et pro sua dignitate et pro rerum magnitudine in summa severitate versatur. Alter eos qui nos omnes, qui populum Romanum, vita privare conati sunt, qui delere imperium, qui populi Romani nomen exstinguere, punctum temporis frui vita et hoc communi spiritu non putat oportere; atque hoc genus poenae saepe in improbos civis in hac re publica esse usurpatum recordatur.

What was the legal point involved in this question? Give syntax of *morte*, *vita*, *punctum*.

(*Pro Archia poeta*, 3.) Nam ut primum ex pueris excessit Archias, atque ab eis artibus quibus aetas puerilis ad humanitatem informari solet se ad scribendi studium contulit, primum Antiochiae—nam ibi natus est loco nobili—celebri quondam urbe et copiosa, atque eruditissimis hominibus liberalissimisque studiis adfluenti, celeriter

antecellere omnibus ingeni gloria contigit. Post in ceteris Asiae partibus cunctaeque Graeciae sic ejus adventus celebrabantur, ut famam ingeni exspectatio hominis, exspectationem ipsius adventus admiratioque superaret.

V.—SIGHT READING.

(*Caes. De Bello Civili*, *Bk. I*, 70.) Erat in celeritate omne positum certamen, utri prius angustias montesque occuparent; sed exercitum Caesaris viarum difficultates tardabant, Afranii copias equitatus Caesaris insequens morabatur. Res tamen ab Afranianis huc erat necessario deducta, ut, si priores montes, quos petebant, attigissent, ipsi periculum vitarent, impedimenta totius exercitus cohortisque in castris relictas servare non possent; quibus interclusis exercitu Caesaris auxilium ferri nulla ratione poterat.

VI. LATIN PROSE COMPOSITION.

Translate into Latin:

In eight years Caesar subdued the whole of Gaul and joined it to the empire of Rome. Being called hence by the outbreak of the civil war he hastened to march to Rome with forced marches in order to attack Pompey, who had attempted to deprive him of power. If he had remained longer in Farther Gaul he might have conquered Britain, which he had visited, but not occupied. After his victory at Pharsalus he was made dictator, and ruled the Roman Empire until his death.

VII. ROMAN HISTORY.

1. Who was Servius Tullius, and what was he said to have done for the development of the Roman Constitution?
2. Give an account of the destruction of Rome by the Gauls.
3. Give the chief events of the First Punic War.
4. Relate the story of Marius.
5. Give the career of Tiberius Gracchus.

IX.—GREEK.

I. Grammar.

1. Contract *τιμάουσι, φιλέετε, δήλοε, σῶος.*

Write correctly *ἰδ-θι, λελειπ-σαι, δεδεχ-μαι, συν-γιγνομαι, θεντ-ς, πεπλεκ-σθε.*

Through what euphonic changes are *στέλλω, τείνω, θάσσων, ἐλπίζω* formed ?

2. Give with accent acc. sing. of *ἀληθεια, πειρα*; gen. sing. of *δεσποινα, εὐνοια*; voc. sing. of *γεωμέτρης, δεσπότης.*

3. Prefix the article indicating the case of each of the following: *νεῴ, συκᾶν, πλοῦς, νώ, ὀστᾶ.*

4. Give gen., acc., and voc., both sing. and plur., of *θρίξ, γέρας, τεῖχος, πῆχυς, ἰχθύς, ναῦς, γαστήρ, ἀστήρ, γόνυ.*

5. Give gen. and acc. sing., and dat. and acc. plur., all genders, of *ὑγιής, γλυκύς, πᾶς, δούς, χαρίεις.*

6. Give other degrees of comparison to *χαρίεις, βελτίων, ἥδιον, βεβαίως, μάλιστα.*

7. Write (in Greek) cardinal numbers to the figures *ι΄, ιδ΄, ρ΄*; also ordinal adjectives and numeral adverbs.

8. Conjugate act. pres. indic. of *ζάω*; act. pres. opt. of *δηλόω*; act. perf. ind. of *ἵστημι.* Give synopsis of act. aor. of *δίδωμι*; pass. aor. of *τίθημι.*

9. *φανῶ, λυθῶ, τεθῶ, ἐτύψω*: where made? Give in each case the first person singular (a) of the optative in the same tense; (b) of the present indicative.

II. Xenophon.

Translate:

Καὶ εἰς μὲν τὴν ὑστεραίαν οὐχ ἧκεν· ὥσθ' οἱ Ἕλληνες ἐφρόντιζον· τῇ δὲ τρίτῃ ἥκων ἔλεγεν ὅτι διαπεπραγμένος ἥκοι παρὰ βασιλέως δοθῆναι αὐτῷ σώζειν τοὺς Ἕλληνας, καίπερ πάνυ πολλῶν ἀντιλεγόντων ὡς οὐκ ἄξιον εἴη βασιλεῖ ἀφεῖναι τοὺς ἐφ' ἑαυτὸν στρατευσαμένους. τέλος δὲ εἶπε, Καὶ νῦν ἔξεστιν ὑμῖν πιστὰ λαβεῖν παρ' ἡμῶν ἦ μὴν φιλίαν παρέξειν ὑμῖν τὴν χώραν καὶ ἀδόλως ἀπάξειν εἰς τὴν Ἑλλάδα ἀγοράν παρέχοντας· ὅπου δ' ἂν μὴ ᾖ πρίασθαι, λαμβάνειν ὑμᾶς ἐκ τῆς χώρας ἐάσομεν τὰ ἐπιτήδεια. ὑμᾶς δ' αὖ ἡμῖν δεήσει ὀμόσαι ἦ μὴν πορεύσεσθαι ὡς διὰ φιλίας ἀσινῶς σῖτα καὶ ποτὰ λαμβάνοντας ὁπόταν μὴ ἀγορὰν παρέχωμεν· ἢν δὲ παρέχωμεν ἀγορὰν, ὠνουμένους ἕξειν τὰ ἐπιτήδεια.

Write the quotation *διαπεπραγμένος . . . στρατευσαμένους* in the form of direct discourse.

Give the principal parts of *ἀφεῖναι, λαβεῖν, πρίασθαι, ὀμόσαι.*

Explain construction of *ὑστεραίαν, τρίτῃ, δοθῆναι, πολλῶν*; explain use of each participle.

Translate:

Ἔνθα δὴ οἱ Ἕλληνες ἔγνωσαν ὅτι πλαίσιον ἰσόπλευρον πονηρὰ τάξις εἴη πολεμίων ἑπομένων. ἀνάγκη γάρ ἐστιν, ἢν μὲν συγκύπτῃ τὰ κέρατα τοῦ πλαισίου, ἢ ὁδοῦ στενωτέρας οὔσης, ἢ ὀρέων ἀναγκαζόντων ἢ γεφύρας, ἐκθλίβεσθαι τοὺς ὁπλίτας, καὶ πορεύεσθαι πονηρῶς, ἅμα μὲν πιεζομένους, ἅμα δὲ καὶ ταραττομένους· ὥστε δυσχρήστους εἶναι ἀνάγκη ἀτάκτους ὄντας. ὅταν δ' αὖ διάσχῃ τὰ κέρατα, ἀνάγκη διασπᾶσθαι τοὺς τότε ἐκθλιβομένους, καὶ κενὸν γίγνεσθαι τὸ μέσον τῶν κεράτων, καὶ ἀθυμεῖν τοὺς ταῦτα πάσχοντας, πολεμίων ἑπομένων. καὶ ὁπότε δέοι γέφυραν διαβαίνειν, ἢ ἄλλην τινὰ διάβασιν, ἔσπευδεν ἕκαστος βουλόμενος φθάσαι πρῶτος· καὶ εὐεπίθετον ἦν ἐνταῦθα τοῖς πολεμίοις.

Explain the construction of *εἴη, συγκύπτῃ, ἀναγκαζόντων, δυσχρήστους εἶναι, δέοι.*

Translate (at sight):

Ἐπεὶ δ' ἀφίκοντο πρὸς χωρίον ὃ πόλιν μὲν οὐκ εἶχεν οὐδ' οἰκίας, συνεληλυθότες δ' ἦσαν αὐτόσε καὶ ἄνδρες καὶ γυναῖκες καὶ κτήνη πολλά, Χειρίσοφος μὲν πρὸς τοῦτο προσέβαλλεν εὐθὺς ἥκων· ἐπειδὴ δὲ ἡ πρώτη τάξις ἀπέκαμνεν, ἄλλη προσῄει καὶ αὖθις ἄλλη· οὐ γὰρ ἦν ἀθρόοις περιστῆναι, ἀλλὰ ποταμὸς ἦν κύκλῳ. ἐπειδὴ δὲ Ξενοφῶν ἦλθε σὺν τοῖς ὀπισθοφύλαξι καὶ πελτασταῖς καὶ ὁπλίταις, ἐνταῦθα δὴ λέγει Χειρίσοφος· Εἰς καλὸν ἥκετε· τὸ γὰρ χωρίον αἱρετέον· τῇ γὰρ στρατιᾷ οὐκ ἔστι τὰ ἐπιτήδεια, εἰ μὴ ληψόμεθα τὸ χωρίον. Ἐνταῦθα δὴ κοινῇ ἐβουλεύοντο· καὶ τοῦ Ξενοφῶντος ἐρωτῶντος τί τὸ κωλῦον εἴη εἰσελθεῖν, εἶπεν ὁ Χειρίσοφος· Μία αὕτη πάροδός ἐστιν ἣν ὁρᾷς· ὅταν δέ τις ταύτῃ πειρᾶται παριέναι, κυλίνδουσι λίθους ὑπὲρ ταύτης τῆς ὑπερεχούσης πέτρας· ὃς δ' ἂν καταληφθῇ, οὕτω διατίθεται. ἅμα δ' ἔδειξε συντετριμμένους ἀνθρώπους καὶ σκέλη καὶ πλευράς.

III. HOMER.

"ὤμοι, τέκνον ἐμόν, τί νύ σ' ἔτρεφον αἰνὰ τεκοῦσα;
αἴθ' ὄφελες παρὰ νηυσὶν ἀδάκρυτος καὶ ἀπήμων
ἧσθαι, ἐπεί νύ τοι αἶσα μίνυνθά περ, οὔτι μάλα δήν.
νῦν δ' ἅμα τ' ὠκύμορος καὶ ὀϊζυρὸς περὶ πάντων

ἔπλεο · τῷ σε κακῇ αἴσῃ τέκον ἐν μεγάροισιν.
τοῦτο δέ τοι ἐρέουσα ἔπος Διὶ τερπικεραύνῳ
εἶμ' αὐτὴ πρὸς Ὄλυμπον ἀγάννιφον, αἴ κε πίθηται.

By whom were these words said? To whom? On what occasion? To what does *αἶσα* refer?

Explain construction of *τί, ἧσθαι, τῷ, αἴσῃ.*

Give prose forms of *νηυσίν, ἐρέουσα, αἴ κε.*

Mark quantities, feet, and caesuras.

’Αλλ’ ὅτε δή ῥ’ ἵκοντο μετὰ Τρῶας καὶ ’Αχαιοὺς,
ἐξ ἵππων ἀποβάντες ἐπὶ χθόνα πουλυβότειραν
ἐς μέσσον Τρώων καὶ ’Αχαιῶν ἐστιχόωντο.
ὤρνυτο δ’ αὐτίκ’ ἔπειτα ἄναξ ἀνδρῶν ’Αγαμέμνων,
ἂν δ’ ’Οδυσεὺς πολύμητις · ἀτὰρ κήρυκες ἀγαυοὶ
ὅρκια πιστὰ θεῶν σύναγον, κρητῆρι δὲ οἶνον
μίσγον, ἀτὰρ βασιλεῦσιν ὕδωρ ἐπὶ χεῖρας ἔχευαν.
’Ατρείδης δὲ ἐρυσσάμενος χείρεσσι μάχαιραν,
ἥ οἱ πὰρ ξίφεος μέγα κουλεὸν αἰὲν ἄωρτο,
ἀρνῶν ἐκ κεφαλέων τάμνε τρίχας · αὐτὰρ ἔπειτα
κήρυκες Τρώων καὶ ’Αχαιῶν νεῖμαν ἀρίστοις.

Give present form of *ἵκοντο, ἐστιχόωντο, ὤρνυτο, ἔχευαν, ἄωρτο, νεῖμαν.*

δ’ (lines 4, 5); *δέ* (lines 6, 8): why is *ε* elided in the former cases and not in the latter?

IV. History.

1. Give an account of Miltiades; of Cimon; of Pericles.

2. Describe the battle of Salamis.

3. How did Athens become powerful and how did she lose her power?

4. Who were the Thirty Tyrants?

5. Describe the career of Epaminondas.

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Herbert Spencer Stauffer,	C.E.,	South Bethlehem.
Herman Arnold Straub,	C.E.,	Pittsburg.
Charles Meredith Strawn,	E.E.,	Quakertown.
John Fife Symington,	M.E.,	Baltimore, Md.
Richard Ferrier Taylor,	E.E.,	Bethlehem.
Edward T. Thornton,	E.M.,	Philadelphia.

	COURSE.	RESIDENCE.
Grandison Gridley Underhill,	C. E.,	East Aurora, N.Y.
James Strawbridge Van Alen,	E. E.,	Northumberland.
Frederick Dana Viehe,	A.C.,	Atlanta, Ga.
George William Welsh,	E. E.,	Hanover.
John Whitridge,	C. E.,	Baltimore, Md.
Edwin Benton Wilkinson,	A.C.,	Williamsport.
Henry Dalzell Wilson,	M.E.,	Pittsburg.
Thomas Wilbraham Wright,	E.M.,	Philadelphia.
Arthur Reuben Young,	C.E.,	West Bethlehem.

FRESHMAN CLASS.

	COURSE.	RESIDENCE.
Daniel Agnew, jr.,	C.E.,	Lancaster.
Arthur Garfield Bachman,	A. C.,	Lancaster.
Felix Bareis, jr.,	M. E.,	Cumberland, Md.
Robert Ernst Baum,	M. E.,	Bethlehem.
William Frederick Berger,	M. E.,	South Bethlehem.
Robert Montgomery Bird,	M. E.,	South Bethlehem.
Phillips Blagden,	E.M.,	New York City.
Allan Gordon Bohannon,	E. E.,	Hickory, N.C.
William Smith Brownell, jr.,	A. C.,	Newport, R.I.
William Taggart Carpenter,	M. E.,	Pittston.
Luis Cuesta,	C. E.,	Guadalajara, Mex.
John Atkinson Cunningham,	E. E.,	Henderson, Ky.
James Thomas Davies,	Sci.,	Catasauqua.
Louis De Sauque Dibert,	M. E.,	Johnstown.
Alpha Albert Diefenderfer,	A. C.,	Allentown.
James Nethermark Downey,	E. E.,	Lancaster.
Claudio Dumás,	E.E.,	Matanzas, Cuba.
Edmund M. Erb,	E. E.,	Slatington.
Carl Watson Evans,	E. E.,	Great Falls, Mont.
William L. Fleming,	E. M.,	New Castle.
Henry Le Roy Fryer,	C. E.,	Chester.
Thomas K. Reed Gardner,	C. E.,	Egg Harbor City, N. J.

	COURSE.	RESIDENCE.
John Thomas Gavan,	C.E.,	Scranton.
William Berger Geiser,	Sci.,	Bath.
Peter William Gleason,	M.E.,	South Bethlehem.
Felix Golian,	C.E.,	Phoenixville.
Charles Albert Gradwohl,	E.E.,	South Bethlehem.
William Thomas Griffith,	E.M.,	Kane.
Robert Franklin Gross,	E.M.,	Bethlehem.
Maximilian Showzo Hachita,	E.M.,	Sanuki, Japan.
William Rankin Hall,	M.E.,	Middletown, Del.
George Wellington Hamilton,	E.E.,	Pottsville.
Irad Hawley, jr.,	M.E.,	East Orange, N.J.
John S. Hegeman,	M.E.,	Bethlehem.
William Louis Heim,	E.E.,	Kane.
Foster Hewett,	E.M.,	Corona, Ala.
Arthur Clark Hill,	M.E.,	Willimantic, Conn.
Joseph Earl Hill,	E.E.,	Bethlehem.
Albert Cass Hutchinson,	C.E.,	Mishawaka, Ind.
Robert Jarecki,	M.E.,	Erie.
William Henry Jaxheimer,	M.E.,	Bethlehem.
Walter Scott Johns,	C.E.,	Martindale.
John Patrick Kelly,	C.E.,	Salamanca, N.Y.
Charles Edgar Kendig,	E.E.,	Baltimore, Md.
Walter Savage Landis,	M.E.,	Pottstown.
Ricardo León,	M.E.,	Chiapas, Mex.
Gay Breton Leroux,	C.E.,	Annapolis, Md.
Allen Ledyard Lindley,	E.M.,	New York City.
Frederick Farrar Lines,	E.M.,	South Bethlehem.
Robert Spear Lowry,	M.E.,	Butler.
Myron Jacob Luch,	Clas.,	Santee.
Joseph Treanor McNaier,	E.E.,	Yonkers, N. Y.
José M. Mendoza,	M.E.,	Lima, Peru.
Elmer McClellan Milheim,	E.E.,	Bloomsburg.
Clinton Laubach Mill,	M.E.,	Springtown.
Anthony J. Monaghan,	E.E.,	Shenandoah.
William Lloyd Morgan,	C.E.,	Harwood Mines.
Charles Edwin Pugh Murray,	C.E.,	Columbia.
Floyd William Parsons,	E.M.,	Grafton, W.Va.
Wilbur Hendrickson Peepels,	M.E.,	Lancaster.

	COURSE.	RESIDENCE.
Raymond Thomas Peppell,	M.E.,	Allentown.
Amalat Rainos,	M.E.,	Chiapas, Mex.
William Frank Roberts,	M.E.,	Freeland.
Daniel Martin Sachs, jr.,	M.E.,	Gowen.
James Cadwalader Sellers, jr.,	E.E.,	West Chester.
William Roy Shively,	M.E.,	Philadelphia.
John J. Shonk, jr.,	M.E.,	Plymouth.
Joseph Aiken Simons,	E.E.,	Charleston, S. C.
William Penn Slifer,	C.E.,	Bingen.
Paul Helsel Smith,	E.E.,	Butler.
Edmund Sewell Stevens,	C.E.,	Allentown.
Hopkin Thomas,	E.E.,	Catasauqua.
William Ernest Thomas,	E.M.,	Philadelphia.
Robert Wm. Thoroughgood,	C.E.,	Georgetown, Del.
George William Webb,	M.E.,	South Bethlehem.
James Brookes Wright,	M.E.,	S. McAlester, Ind. Ty.

SPECIAL STUDENTS.

	COURSE.	RESIDENCE.
David Maurice Barry,	E.M.,	Agawam, Mass.
Frederick William Benzé,	L.S.,	Erie.
Benjamin Sargent Hanna,	C.E.,	Baltimore, Md.
Mason Benedict Lawton,	C.E.,	Rome, N. Y.
Walter S. Smith,	C.E.,	Forty Fort.
Ray Wilbur,	Arch.,	South Bethlehem.

SUMMARY OF STUDENTS BY STATES.

Maine,	1
Massachusetts,	3
Connecticut,	2
Rhode Island,	1
New York,	31
New Jersey,	23
Pennsylvania,	176
Delaware,	2
Maryland,	14
District of Columbia,	6
Virginia,	4
West Virginia,	3
North Carolina,	2
South Carolina,	1
Georgia,	2
Alabama,	1
Florida,	1
Kentucky,	4
Tennessee,	3
Indiana,	3
Illinois,	4
Michigan,	2
Wisconsin,	1
Missouri,	1
Kansas,	1
Colorado,	1
South Dakota,	1
Utah,	1
Montana,	3

California,	1
Indian Territory,	1
Mexico,	9
Cuba,	5
Porto Rico,	2
Nicaragua,	1
Venezuela,	2
Brazil,	1
Ecuador,	1
Peru,	1
France,	1
Armenia,	1
Japan,	1
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SUMMARY OF STUDENTS BY CLASSES AND COURSES.

	GRADUATES.	SENIORS.	JUNIORS.	SOPHOMORES.	FRESHMEN.	SPECIALS.	TOTALS.
Classical,	6	—	1	2	1	—	10
Latin-Scientific,	—	—	1	1	—	1	3
Science and Letters,	2	1	2	—	2	—	7
Civil Engineering,	4	15	22	17	15	3	76
Mechanical Eng.,	1	15	27	28	27	—	98
Mining Eng.,	5	3	15	11	10	1	45
Electrical Eng.,	2	10	10	17	18	—	57
Analytical Chem.,	1	7	8	5	3	—	24
Architecture,	—	1	3	—	—	1	5
Totals,	21	52	89	81	76	6	325

ALUMNI

OF THE

LEHIGH UNIVERSITY.

CLASS OF 1869.

*J. Haynes Hinds Corbin, A.C.

Miles Rock, C.E., Astronomer, Chief Engineer, and President of the Boundary Commission of Guatemala with Mexico, Guatemala City, Central America.

Charles Edward Ronaldson, M.E., Mechanical Engineer, 4017 Locust Street, Philadelphia, Pa.

CLASS OF 1870.

*Lehman Preston Ashmead, A.C., M.D.

Richard Brodhead, M.E., Attorney-at-Law, 32 Nassau Street, New York City.

William R. Butler, M.E., Manufacturer, Mauch Chunk, Pa.

George A. Jenkins, A.C., South Bethlehem, Pa.

William J. Kerr, A.C., M.E., Supt. Motive Power, Union Traction Co., 820 Dauphin Street, Philadelphia, Pa. Residence: 1010 South 49th Street.

*Harry E. Packer, A.C.

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Henry B. Reed, B.A., M.D., Physician (retired), Milford, Pike Co., Pa.

*William Dunlop Ronaldson, B.A., M.D.

John M. Thome, C.E., Ph.D., Director National Astronomical Observatory, Cordova, Argentine Republic, S.A.

*Russel B. Yates, C.E.

* Deceased.

CLASS OF 1871.

Jacob Neff Barr, M.E., Superintendent Motive Power, Chicago, Milwaukee & St. Paul Ry., 3028 Wells Street, Milwaukee, Wis.

Frank Laurent Clerc, C.E., Mining, Philipsburg, Pa.

Henry S. Drinker, E.M., Lawyer; General Solicitor of the Lehigh Valley Railroad Co., 26 Cortlandt Street, New York City. Vice-President East Jersey Water Co., 2 Wall Street, New York City. Residence and mailing address: Haverford, Pa.

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Waldron Shapleigh, A.C., Chemist, Welsbach Light Company, Gloucester City, N.J. Residence: 2223 Delancey Street, Philadelphia, Pa.

*Charles G. Weaver, C.E.

CLASS OF 1872.

George Pierrepont Bland, C.E., President, Keystone Structural Co., 510 Harrison Building, Philadelphia, Pa. Residence: 3220 Woodland Avenue.

Daniel P. Bruner, C.E., Civil Engineer, Architect, and Builder, 501 W. Chelten Ave., Germantown, Philadelphia, Pa.

Henry St. Leger Coppée, C.E., U. S. Assistant Engineer, in charge of U. S. Levees in Mississippi, Greenville, Miss.

*F. R. Christian Degenhart, A.C.

Harvey S. Houskeeper, B.A., Principal of State Academy, Brookeville, Md.

*Lentz Edmund Klotz, C.E.

Oscar Moore Lance, A.C., General Manager, Spring Brook Water Supply Co., Plymouth, Pa.

Raymundo Floresta de Miranda, M.E., Division Engineer, Rio de Janeiro and Northern R. R. Address: E. F.

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* Deceased.

Principe de Grao Pará, Estaçaodo Areal, Rio de Janeiro, Brazil.

James S. Polhemus, C.E., Assistant U. S. Engineer, in local charge Coos Bay Harbor Improvements, Empire, Oregon.

Henry Darcy Scudder, C.E., Lumber and Coal, 344 Perry Street, Trenton, N.J.

CLASS OF 1873.

Washington Hopkins Baker, A.C., M.D., Physician and Life Insurance Examiner, 1610 Summer Street, Philadelphia, Pa.

Robert B. Claxton, C.E., 5116 Newhall St., Germantown, or University Club, Philadelphia, Pa.

James Peyton Stuart Lawrance, M.E., Chief Engineer U.S. Navy, U.S. Gunboat "Wilmington." Permanent address: care of Navy Department, Washington, D.C.

Hildebrando Barjona de Miranda, A.C., Professor of English, Lyceo Paraence, Belém do Pará, Estades Unidos do Brazil.

Wallace McIlvaine Scudder, M.E., Publisher Newark *Evening News*. Residence: 10 Washington Place, Newark, N. J.

CLASS OF 1874.

Caspar Wistar Haines, A.M. (Haverford '72), C.E., of the firm of Silva y Haines, Engineers and Contractors, Puebla, Mexico.

William Davis Hartshorne, C.E., Superintendent Worsted Department, Arlington Mills, Lawrence, Mass. Residence: 40 Pleasant Street, Methuen, Mass.

Allen A. Herr, C.E., Civil Engineer and Real Estate Agent, 108 East King Street, Lancaster, Pa.

Thomas Merritt, C.E., Manager Mutual Life Insurance Co. of New York, 31-32-33 Canadian Bank of Commerce Building, Toronto, Can.

William Marshall Rees, C.E., First Assistant Engineer, Mississippi River Improvement, Appeal Building, Memphis, Tenn.

CLASS OF 1875.

Charles Julius Bechdolt, C.E., Superintendent Central Division P., W. & B. R. R., Media, Pa.

Antonio M. Cañadas, A.C., Chemist, Loja, Ecuador.

John F. Halbach, B.A., B.M., Attorney-at-Law, 1218–1220 Filbert Street, Philadelphia, Pa.

William Arthur Lathrop, C.E., General Superintendent Lehigh Valley Coal Co., Wilkes-Barre, Pa.

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Joseph Morrison, C.E., Resident Engineer for Lines west of the Mississippi River, The Wabash Railroad Co. Residence: 401 S. Clark Street, Moberly, Mo.

Francis Sebastian Pecke, C.E., Secretary, The Nebraska, Kansas & Gulf Railway Company. Residence: 138 Franklyn Place, Flushing, N.Y.

Edward H. Williams, jr., B.A. (Yale), A.C., E.M. ('76), F. G.S.A., Professor of Mining and Geology, Lehigh University. Residence: Twelfth Avenue, (West) Bethlehem, Pa.

*Carl F. Zogbaum, C.E.

CLASS OF 1876.

Frank C. Angle, C.E., Attorney-at-Law, Danville, Montour Co., Pa.

*James DeWitt Carson, C.E.

*Thomas William Frederick, M.E.

William Griffith, C.E., Mining Engineer and Coal Specialist, Coal Exchange, Scranton, Pa. Residence: 405 Susquehanna Ave., West Pittston, Pa.

C. William Macfarlane, C.E., Ph.D. (Freiberg i. B. '93). Narberth, Pa.

Robert W. Mahon, C.E., Ph.D. (Johns Hopkins), Monongahela Furnace Co., McKeesport, Pa.

J. J. de Gama Malcher, M.E., Naval Officer, Custom House, Para, Brazil.

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* Deceased.

Walter Percival Rice, C.E., Civil Engineer, The Walter P. Rice Engineering Company, 545 Society for Savings Building, Cleveland, Ohio. Residence: 293 Euclid Ave.

Henry Richards, E.M., Contractor, Dover, N.J.

Lowdon W. Richards, M.E., Columbia, Pa.

Charles L. Taylor, E.M., Assistant to President, The Carnegie Co., Limited, Carnegie Building, Pittsburg, Pa.

CLASS OF 1877.

John Eagley, C.E., North Springfield, Erie Co., Pa.

Percival D. Giess, C.E., Bethlehem, Pa.

Andrew M. Glassel, C.E., Bowling Green, Va.

George M. Heller, C.E., Bridge Engineer, 853 North 20th Street, Philadelphia, Pa.

Henry Sylvester Jacoby, C.E., Associate Professor of Bridge Engineering and Graphics, Cornell University. Residence: 7 Reservoir Avenue, Ithaca, N.Y.

James Fremont Marsteller, C.E., Superintendent, Snow Shoe Division, Lehigh Valley Coal Co., Snow Shoe, Centre Co., Pa.

*Seizo Miyahara, C.E.

Charles R. Rauch, A.C., Central Hotel, Bethlehem, Pa.

Lewis Theodore Wolle, C.E., Secretary of the Cambria Mining Co., Cambria, Weston Co., Wyoming.

CLASS OF 1878.

Charles Bull, M.E., Assistant Librarian and Bursar, General Theological Seminary, Chelsea Square, New York City.

*James E. Gilbert, C.E.

William Convers Hazlett, M.E., Architect, 151 Broadway, New York City

Frank Perley Howe, B.A. (Brown), E.M., President, The North Branch Steel Co.; Vice-President, Wm. Wharton, jr., & Co., Inc. Residence: 251 South 17th Street, Philadelphia, Pa.

Nathaniel Lafon, M.E., Engineer for Jellico & Bird Eye Coal Co., Halsey, Whitley Co., Ky.

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* Deceased.

Benjamin B. Nostrand, jr., M.E., Electrical Engineer, The Westinghouse Electric and Manufacturing Co.; Treasurer and Manager, The Sing Sing Electric Lighting Co.; President and Treasurer, The Peekskill Electric Light and Power Co., Peekskill, N.Y.

Milnor Peck Paret, C.E., Resident Engineer, Kansas City, Pittsburg & Gulf R.R., Lake Charles, La.

Holbrook Fitz John Porter, M.E., Sales Agent, Bethlehem Iron Co., Bethlehem, Pa.

William K. Randolph, C.E.

Robert H. Read, B.A., Counsel and Expert in Patent Cases, 44 Broad Street, New York City. Residence: East Orange, N. J.

Henry Church Wilson, C.E., Chief Clerk, U. S. Engineer Office, Room C 8, Army Building, New York City.

CLASS OF 1879.

James S. Cunningham, M.E., Superintendent and Chief Engineer, Berwind-White Coal Mining Co., Tyrone, Pa. Residence: Windber, Somerset Co., Pa.

*Joseph Hill Paddock, M.E.

Fitz William Sargent, C.E., General Agent The Sargent Co., 675 Old Colony Building, Chicago, Ill. Residence: Wilmett, Ill. (P. O. Box 273.)

Richard Hawley Tucker, C.E., Astronomer, Lick Observatory, Mt. Hamilton, Cal.

CLASS OF 1880.

Abraham Bruner, E.M., Civil Engineer, Assistant Engineer, Norfolk & Western R.R., Crewe, Nottoway Co., Va.

Murray Morris Duncan, A.C., E.M. ('80), Agent Cleveland-Cliffs Iron Company, Ishpeming, Michigan.

Thomas Hughlett Hardcastle, B.A., M.A. ('82), LL.B., Attorney-at-Law, 601 Boston Building, Denver, Col. Residence: 950 Pearl Street.

John Tinsley Jeter, E.M., Superintendent of the Keystone Coal Co., Wilkes-Barre, Pa. Residence: 222 S. Franklin Street.

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*Deceased.

Charles Francis King, A.C.

George Ernest Potter, C.E, Assistant Engineer, New York, Chicago & St. Louis R. R., 151 Wayne Street, Fort Wayne, Ind.

Frederick Putnam Spalding, C.E., Contracting Engineer, Bethlehem, Pa.

Leonard Blakeslee Treharne, B.A., Editorial Department, *New York Times*, New York City.

Benjamin Russell Van Kirk, M.E., Locomotive Designer, Baldwin Locomotive Works, 2105 Green Street, Philadelphia, Pa.

*Frederick Copeland Wooten, M.E.

CLASS OF 1881.

William Simon Cranz, A.C., Purchasing and Development of Mining Property, Nogales, Arizona.

Alexander Patrick Crilly, B.A., Allentown, Pa.

Thomas Morgan Eynon, M.E., General Manager, The Eynon-Evans Mfg. Co., 15th and Clearfield Streets, Philadelphia, Pa. Residence: 3102 North 15th Street.

Charles Weed Gray, A.C., with Central of Georgia Ry., Chicago, Ill.

Benjamin Franklin Haldeman, E.M., Superintendent, Bessemer Department, Cambria Steel Co., Johnstown, Pa. Residence: Fayette Street, Westmont, Johnstown.

Lewis Stockton, B.A., Counselor-at-Law, Erie Bank Building, Cor. Niagara and Main Streets, Buffalo, N. Y. Residence: Cor. North and Franklin Streets.

CLASS OF 1882.

Louis Oscar Emmerich, E.M., Mining Engineer, Hazleton, Pa.

Charles Comstock Hopkins, B.S. (Sci.), C.E. ('84), member of firm of The Stanwix Engineering Co., Hydraulic and Sanitary Engineers, Rome, N.Y.

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*Deceased.

Elmer Henry Lawall, C.E., Mining and Consulting Engineer, Vice-President Colliery Engineer Co., Scranton, Pa. Residence: 133 S. Franklin St., Wilkes-Barre, Pa.

Robert Thomas Morrow, C.E., Assistant Engineer, Elmira and Canandaigua Divisions, N. C. Ry., Elmira, N. Y. Residence: 702 Park Place.

Eugene Ricksecker, C.E., Civil Engineer, U. S. Assistant Engineer in local charge of fortification work, Marrowstone Point, Seattle, Washington.

John Dougherty Ruff, E.M., 328 South 21st Street, Philadelphia, Pa.

*Samuel Brenton Sickler, C.E.

Martin Wittmer, E.M., Superintendent Wittmer Brick Co., Limited, Glen Shaw, Allegheny Co., Pa.

CLASS OF 1883.

*Enos Kellar Bachman, E.M.

Walter Briggs, B.A., Attorney-at-Law, Board of Trade Building, Scranton, Pa. Residence: 1505 Adams Ave.

Henry Augustus Butler, B.S. (Sci.), Secretary and Treasurer, Carbon Iron and Steel Co., Limited, Mauch Chunk, Pa.

Hedley Vicars Cooke, B.A., LL.M. (Columbian University), Attorney-at-Law, 77-79 Trinity Building, New York City. Residence: 293 Park Avenue, Orange, N.J.

Francis Joseph Crilly, B.A., M.A. ('89), Special Deputy Collector of the Port, Custom House, Philadelphia. Residence: 1926 Spring Garden Street.

Francis Wharton Dalrymple, C.E., City Engineer, 131 Main Street, Hornellsville, N.Y.

Timothy James Donahoe, A.C., Benson Mines, N. Y.

George Francis Duck, E.M., Wholesale Coal Dealer, Room 9, 1 Broadway, New York City. Residence: 41 Madison Street, Brooklyn, N. Y.

Alfred Edmond Forstall, M.E., Secretary and Treasurer, American Gas Light Association; Secretary, Board of Trustees for Educational Work of the Association; Con-

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*Deceased.

sulting Gas Engineer. Residence: 60 Christopher Street, Montclair, N.J.

Nathaniel Oliver Goldsmith, M.E., Principal Engineer, The Weir Frog Co.; Vice-President, The Wefugo Co.; Treasurer, The American Coke Drawer Co., Cincinnati, Ohio. Residence: Glendale, Hamilton Co., O.

William Theodore Goodnow, C.E., General Manager Cayuta Wheel and Foundry Co., and The Sayre Land and Water Co., Sayre, Pa.

John Daniel Hoffman, B.A., M.A. ('89), Counselor-at-Law, 17 Broad Street, Bethlehem, Pa. Residence: 30 N. Main Street.

George Gowen Hood, C.E., Civil Engineer, Mount Airy, Philadelphia, Pa.

Garrett Linderman Hoppes, C.E., Eagle Hotel, Bethlehem, Pa.

Julian de Bruyn Kops, B.E. (University of Georgia), C.E., Assistant City Engineer, Savannah, Ga.

Preston Albert Lambert, B.A., M.A. ('91), Assistant Professor of Mathematics, Lehigh University, South Bethlehem, Pa.

Edwin Francis Miller, M.E., with R. D. Wood & Co., Camden, N.J.

Rev. Wilson Franklin More, B.A., M.A. ('91), Pastor Salem Reformed Church, Catasauqua, Pa.

Nelson Morrow, M.E., Manager of the Deep Rock Mineral Springs, Oswego, N.Y. Residence: 235 W. First St.

Thomas Nicholson, M.E., with the Johnstown R.R. Frog and Switch Co., Chester, Pa.

George Spencer Patterson, E.M., Mining and Civil Engineer, 400 Opera House Building, Terre Haute, Ind.

Rembrandt Richard Peale, B.S. (Sci.), Secretary and Treasurer, Bloomington Mining Co., 411–413 Walnut Street, Philadelphia, Pa.

Henry Allebach Porterfield, E.M., President and General Manager, The Dexter Spring and Gear Co., Inc., Pittsburg, Pa. Residence: 319 S. Hiland Avenue, E.E.

Francis Henry Purnell, C.E., E.M. ('86), Clerk of the Circuit Court, Worcester Co., Snow Hill, Md.

Jesse Wilford Reno, E.M., Rapid Transit Tunnel for New York City; The Reno Inclined Elevator Co.; Mining Expert, Mills Building, New York City.

Charles Loomis Rogers, M.E., General Manager, Milton Car Works, Milton, Pa.

John Ruddle, M.E., General Supervisor, Canal Department, The Lehigh Coal and Navigation Co., Mauch Chunk, Pa.

Charles Henry Stinson, B.S. (Sci.), Attorney-at-Law, Norristown, Pa.

*Robert Stinson, B.S. (Sci.).

CLASS OF 1884.

Robert Grier Cooke, B.A., Journalist, with Collier's Weekly, 521 West 13th Street, New York City. Residence: 43 West 35th Street.

Henry Bowman Douglas, B.M., E.M. ('85), Consulting Mining Engineer, Vintondale, Cambria Co., Pa.

William Banks Foote, B.M., E.M. ('86), Etiwanda, San Bernardino Co., Cal.

Harry Tallman Harper, C.E., Assistant Engineer, Florence & Cripple Creek Railroad, Florence, Col.

Harry Hurd Hillegass, C.E., Civil Engineer, Reading, Pa.

Edwin Franklin Hofford, C.E., Lehighton, Pa.

John Andrew Jardine, B.M., E.M. ('85), with Pilling & Crane, Girard Building, Philadelphia, Pa. Mailing address: Kenvil, Morris Co., N. J.

James Warner Kellogg, M.E., Manager of Marine Sales, General Electric Co., Schenectady, N.Y. Residence: 10 Front Street.

David Garrett Kerr, B.M., Superintendent of Blast Furnace, Edgar Thomson Works, Carnegie Steel Co., Lim., Braddock, Pa. Residence: 17 Kirkpatrick Ave.

Frederick Bowman Langston, C.E., Architect, 1239 Bedford Avenue, Brooklyn, N.Y.

William Langston, C.E., with Dean & Westbrook, Bridge Engineers and Contractors, 136 Liberty St., New York City.

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*Deceased.

Robert Packer Linderman, Ph.B., President of the Bethlehem Iron Company; President of the Lehigh Valley National Bank. Residence: South Bethlehem, Pa.

Joseph Franklin Merkle, C.E., M.D. (Univ. of Pa. '94), Physician and Surgeon, Llewellyn, Pa.

Harry Krider Myers, C.E., with Baldwin Locomotive Works, Philadelphia, Pa. Residence: 3653 North 15th Street.

Albino Rosendo Nuncio, M.E., Chief of the Patent Office, Department of Public Promotion (Secretaria de Fomento), City of Mexico, Mexico.

James Ward Packard, M.E., President, The Packard Electric Co., Manufacturers, Warren, O.

Alfred Scull Reeves, B.M., E.M. ('85), of the firm of Paul S. Reeves & Son, Manufacturers of Phosphor Bronze, Brass, Babbitt Metals, etc., 1415-1425 Catharine Street, Philadelphia, Pa. Residence: 21st Street and Delancey Place.

Barry Searle, A.C., Superintendent Deep Crown Gold Mine, Johannesburg, South African Republic. Permanent address: care of R. S. Searle, Montrose, Pa.

Lewis Buckley Semple, B.A., M.A. ('91), Ph.D. (Princeton), Instructor in English, Lehigh University.

Augustus Parker Smith, M.E., LL.B. (Georgetown Univ.), Counsel in Patent Cases, 45 Broadway, New York City. Residence: Hotel Lincoln, 52d Street and Broadway.

Murray Stewart, M.E., Motive Power Department, Philadelphia, Wilmington & Baltimore R. R. Co., Wilmington, Del.

Richard Washington Walker, C.E., Glen Moore, Pa.

James Angus Watson, C.E., Patent Lawyer, 931 F Street, N.W., Washington, D. C. Residence: 1454 Howard Avenue.

CLASS OF 1885.

Warren Howard Allen, A.C., Clerk, Farmers' National Bank, Athens, Pa.

Harrison Link Auchmuty, C.E., Assistant Chief Engineer, H. C. Frick Coke Co., Loucks Ave., Scottdale, Pa.

*Theodore Weld Birney, C.E.

Harry Luther Bowman, B.M., care of Y. M. C. A., Harrisburg, Pa.

William Harvey Cooke, B.A., M.D., 10 N. Munn Avenue, East Orange, N. J.

William Noble Edson, C.E., of the firm of Edson Brothers, General Contractors, Phelps, N.Y.

*John Roberts Engelbert, C.E.

Felix Freyhold, C.E., Draftsman, Bureau of Yards and Docks, Room 166, Navy Department, Washington, D.C. Residence: 236 First Street, S.E.

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David Kirk Nicholson, M.E., with the Carnegie Steel Co., Limited, Braddock, Pa.

*Fayette Brown Petersen, C.E.

John Bertsch Price, C.E., Cashier, First National Bank, Hazleton, Pa.

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William Bailey Taylor, E.E., Testing Department, General Electric Co., Schenectady, N.Y.

John Augustus Thomson, B.S., E.M. ('97), with The Mazapil Copper Co., Limited, Concepcion del Oro, *via* Laredo and Santillo, Zacatecas, Mexico.

Edward Coppée Thurston, B.S. (in Metallurgy), Engineer, Robinson Deep Mining Co., Johannesburg, South African Republic.

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CLASS OF 1897.

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Lathrop Hutchings Baldwin, M.E., with the Vermont Marble Co., Proctor, Vt.

Charles Marshall Barton, C.E., Supervisor, L. V. R. R., Rochester, N. Y.

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Bertine Frederic Borhek, A.C., Chemist for Somerset Chemical Co., Bound Brook, N. J.

Charles Schwartze Bowers, E.E., with J. F. Buchanan & Co., Electrical Contractors, Philadelphia, Pa. Residence: 1606 North 15th Street.

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Walter Everette Brown, E.E., Stamford, Conn.

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Ross Nathaniel Hood, E.E., Duncannon, Pa.

Henry Taylor Irwin, M.E., Rosedale Foundry Co., Allegheny, Pa. Residence: 15 North Avenue.

Arthur Perkins Jenks, E.E., Testing Department, General Electric Company, Schenectady, N.Y. Residence: 29 Front Street.

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CLASS OF 1898.

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Frank Hammond Gunsolus, C.E., late First Lieutenant, 49th Iowa Regiment, U. S. V. Engineering Corps, P. R.R., 32d St. and Powelton Ave., Philadelphia, Pa. Residence: 3217 Race Street.

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Raymond Hazel, E.E., Cressona, Pa.

Henry Bruner Hershey, E.E., Draftsman and Computer of Special Work, Frog, Switch, and Signal Department, Pennsylvania Steel Co., Steelton, Pa. Residence: 324 Pine Street.

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Clarence Albert Loomis, C.E., Civil Engineer, Inspector for Lake Superior Power Co., Sault Ste. Marie, Mich.

Lee Holmes Marshall, M.E., with Marshall Bros., Elevator Builders, Diamond Street, Pittsburg, Pa. Residence: 814 Lilac St., E.E.

*Charles Francis Moritz, E.E.

José Aristides de Obaldia, C.E., 895 Avenida Bolivar, David, Panama, Rep. Col.

John O'Reilly, A.C., South Bethlehem, Pa.

Howard Charles Paddock, C.E., Draftsman for The New England Structural Co., Everett, Mass.

* Deceased.

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Carroll Winston Quarrier, M.E., Draftsman, with Julian Kennedy, M.E., Pittsburg, Pa. Residence: Crofton, Pa.

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Harry Bernard Zimmele, A.C., Chemist, Oakland Chemical Co., 465 West Broadway, New York City.

Harry Statten Zimmerman, C.E., Assistant to Division Engineer, Chicago and Erie Division, Erie R. R., Huntington, Ind.

The number of graduates is 1028, degrees having been conferred as follows:

Upon graduates of the School of General Literature: B.A., 51; B.S., 22; Ph.B., 7; M.A., 9.

Upon graduates of the School of Technology: C.E., 360; M.E., 216; B.M., 19; B.S. (in Mining and Metallurgy), 96; E.M., 77; E.E., 139; A.C., 95; B.S. (in Architecture), 13; M.S., 6; Ph. D., 2.

Of these, 9 have taken the degrees of B.A. and M.A.; 2 of B.S. and C.E.; 1 of B.S. and A.C.; 11 of B.M. and E.M.; 43 of B.S. and E.M.; 1 of B.S., B.M., and E.M.; 1 of B.M., E.M., and A.C.; 1 of B.S., E.M., and C.E.; 1 of C.E. and E.M.; 2 of A.C. and E.M.; 1 of M.E. and C.E.; 1 of E.E. and M.S.; 1 of A.C. and M.S.; 1 of B.S., E.M., and M.S.; 2 of A.C., M.S., and Ph. D. 981 graduates are still living.

ONE-YEAR COURSE IN ELECTRICITY.

Beginning with the year 1884-85, the University offered a special course in Electricity, covering one year's work. Those who completed this course received certificates but no degrees. In 1888, the full four-year course in Physics and Electrical Engineering, leading to the degree of E.E., was established, and the one-year course was withdrawn. The names of those who completed this course are not included in the Roll of Alumni, but are here given:

Elmer Ellsworth Boyer, '85, Foreman of Testing Department, General Electric Co., Lynn, Mass.

Albert Brodhead, '88, 121 S. Centre Street, Bethlehem, Pa.

Edward Conner, '86, Philadelphia, Pa.

William Fairchild Dean, '88, Manager Montreal Office, Canadian General Electric Co., Ltd., 1802 Notre Dame Street, Montreal, Can. Residence: 1264 Dorchester St.

Horace Musser Engle, '85, (Economic Geology), Roanoke, Va.

Herman Frauenthal, '88, M.D., 214 E. 50th St., New York City.

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James Arthur Heaton, '86.

Richard Otto Albert Heinrich, '88, General Manager, European Weston Electrical Instrument Co., Ritterstrasse 88, Berlin, Germany.

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Joseph Allison Horner, '88.

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Dion M. Martinez, jr., '87.

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James Leidy Moore, '88, Superintendent, The Moorestown Electric Light, Heat and Power Co., Moorestown, N. J.

George Harrison Neilson, '86, Supervisor, Division No. 3, Philadelphia Div., P. R. R., Parkesburg, Pa.

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Charles Wesley White, '88.

George Henry Wolle, '87, Superintendent Bethlehem Electric Light Co., Bethlehem, Pa.

Hugh Carlyle Young, '88, Superintendent Wellsboro Electric Company, Wellsboro, Tioga County, Pa.

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ALPHABETICAL ALUMNI LIST.

A

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W. J. Adams, jr., '96.
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H. B. Ayers, '96.
A. D. Ayres, '96.
C. T. Ayres, '95.
G. Ayres, '89.

B

*E. K. Bachman, '83.
A. D. Badgley, '96.
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W. H. Baker, '73.
C. K. Baldwin, '95.
F. H. Baldwin, '96.
G. R. Baldwin, '88.
H. W. Baldwin, '96.
L. H. Baldwin, '97.
L. W. Baldwin, '96.
S. Baldwin, '96.
J. Ballard, '98.
C. L. Banks, '88.
H. C. Banks, '93.
N. C. Banks, '93.
A. F. Bannon, '95.
J. C. Barber, '95.
R. P. Barnard, '89.
J. N. Barr, '71.
J. Barrell, '92.
R. W. Barrell, '87.
F. R. Barrett, '90.
A. Barrientos, '98.
G. P. Bartholomew, '96.
R. J. Bartholomew, '95.
F. R. Bartles, '96.
C. M. Barton, '97.

* Deceased.

J. Y. Bassell, jr., '92.
J. N. Bastress, '92.
R. C. Bastress, '95.
A. H. Bates, '89.
E. A. Bates, '88.
G. W. S. Baton, '94.
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J. M. Beaumont, '92.
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G. W. Beggs, '95.
I. I. Beinhower, '94.
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F. B. Bell, '98.
H. L. Bell, '97.
S. E. Berger, '89.
M. Bernstein, '96.
J. H. Best, '95.
W. J. Bieber, '96.
W. R. Binkley, 97.
*T. W. Birney, '85.
H. D. Bishop, '98.
G. P. Bland, '72.
E. M. Blehl, '95.
H. R. Blickle, '93.
D. W. Bliem, '96.
W. W. Blunt, '92.
J. E. Boatrite, '91.
A. Bonnot, '87.
H. A. Bonzano, '88.
G. R. Booth, '86.
B. F. Borhek, '97.
H. T. Borhek, '98.
B. F. Bossert, '96.

C. S. Bowers, '97.
W. Bowie, '95.
H. L. Bowman, '85.
J. W. Boyd, '91.
W. I. Boyd, '93.
H. F. Boyer, '96.
C. H. Boynton, '89.
J. Boyt, '97.
W. Bradford, '88.
W. B. Brady, '97.
W. Y. Brady, '92.
E. E. Bratton, '96.
F. E. Bray, '93.
T. J. Bray, jr., '94.
R. S. Breinig, '86.
C. S. Bricker, '95.
W. Briggs, '83.
L. C. Brink, '94.
R. B. Brinsmade, '95.
R. Brodhead, '70.
F. S. Bromer, '96.
J. E. Brooks, '95.
D. J. Broughal, '98.
E. C. Brown, '95.
H. F. Brown, '98.
J. H. Brown, '86.
R. B. Brown, '94.
W. E. Brown, '97.
W. H. Brown, '95.
W. T. Brown, '95.
A. T. Bruegel, '88.
A. Bruner, '80.
D. P. Bruner, '72.
J. E. Bucher, '91.
M. J. Bucher, '96.
P. Bucher, '98.
C. A. Buck, '87.
J. B. Buckley, '91.

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* Deceased.

J. C. Buckner, '87.
J. H. Budd, '95.
J. L. Budd, '89.
E. D. Buel, '94.
C. Bull, '78.
C. C. Burgess, '95.
O. C. Burkhardt, '88.
J. L. Burley, '94.
G. F. Burnett, '93.
C. N. Butler, '88.
H. A. Butler, '83.
W. R. Butler, '70.
G. A. Buvinger, '96.
M. L. Byers, '88.

C

J. T. Callaghan, jr., '95.
E. Campbell, '89.
A. M. Cañadas, '75.
A. Cardenas, '90.
F. J. Carman, '89.
W. C. Carnell, '94.
A. B. Carpenter, '96.
M. Carrington, '96.
T. F. Carroll, '94.
H. M. Carson, '89.
*J. DeW. Carson, '76.
C. M. Case, '92.
G. P. Case, '92.
F. L. Castleman, '95.
G. E. Chamberlain, '93.
E. Chao, '91.
H. W. Chester, '89.
R. E. Chetwood, jr., '95.
D. H. Childs, '98.
S. W. Chiles, '97.
T. H. Clagett, '97.
C. E. Clapp, '86.
J. J. Clark, '88.
R. B. Claxton, '73.
F. L. Clerc, '71.
W. P. Cleveland, '90.
A. S. Clift, '95.
F. R. Coates, '90.
G. H. Cobb, '86.
P. L. Cobb, '92.
F. A. Coleman, '92.
W. W. Coleman, '95.
W. J. Collier, '95.
G. P. Connard, '88.
F. L. Cooke, '96.
H. V. Cooke, '83.
M. L. Cooke, '95.
R. G. Cooke, '84.
W. H. Cooke, '85.
W. S. Cope, '90.
H. St. L. Coppée, '72.
*J. H. H. Corbin, '69.
W. Corbin, '89.
J. C. Cornelius, '89.
W. A. Cornelius, '89.
C. E. Coxe, '90.
E. H. Coxe, '91.
W. S. Cranz, '81.
H. M. Crawford, '95.
H. M. S. Cressman, '95.
W. F. Cressman, '93.
W. Cresson, '91.
A. P. Crilly, '81.
F. J. Crilly, '83.
J. B. Cullum, '90.
B. A. Cunningham, '87.
E. S. Cunningham, '96.
J. S. Cunningham, '79.

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* Deceased.

B. O. Curtis, '97.
S. P. Curtis, '96.
S. D. Cushing, '92.

D

F. A. Daboll, '96.
H. M. Daggett, '98.
J. W. Dalman, '96.
F. W. Dalrymple, '83.
R. Daniels, '88.
G. Davies, '98.
G. H. Davis, '88.
H. H. Davis, '92.
J. R. Davis, '91.
M. Davis, jr., '92.
W. R. Davis, '92.
W. S. Davis, '88.
W. H. Dean, '86.
C. H. Deans, '89.
W. J. Dech, '93.
H. S. Deck, '95.
*F. R. C. Degenhart, '72.
W. A. Dehm, '98.
H. DeHuff, '95.
J. W. DeMoyer, '90.
C. M. Denise, '98.
H. Denman, '92.
S. M. Dessauer, '96.
*C. H. Detwiler, '90.
P. H. DeWitt, '88.
S. C. deWitt, '95.
J. C. Dick, '95.
W. C. Dickerman, '96.
C. E. Dickerson, jr., '89.
E. Diebitsch, '89.
P. E. Dinan, '97.
A. B. Diven, '94.
E. Diven, '87.
L. Diven, '97.
E. Dodge, '92.
M. V. Domenech, '88.
T. J. Donahoe, '83.
A. Doolittle, '87.
E. Doolittle, '91.
J. W. Dougherty, '89.
C. M. Douglas, '93.
H. B. Douglas, '84.
W. J. Douglas, '94.
B. I. Drake, '97.
F. R. Dravo, '87.
G. P. Dravo, '88.
R. M. Dravo, '89.
P. Drayton, '92.
H. S. Drinker, '71.
B. DuBarry, jr., '95.
G. F. Duck, '83.
F. O. Dufour, '96.
M. M. Duncan, '80.
C. G. Dunnells, '97.
W. S. Dunscomb, '94.
C. H. Durfee, '93.
E. M. Durham, jr., '96.
E. H. Dutcher, jr., '96.
E. H. DuVivier, '89.

E

J. Eagley, '77.
A. Eavenson, '91.
*H. S. Eckert, '92.
H. Eckfeldt, '95.
J. J. Eckfeldt, '98.
A. W. A. Eden, '95.
T. S. Eden, '96.
L. E. Edgar, '98.
E. D. Edmonston, '98.
W. N. Edson, '85.

* Deceased.

S. R. Elliott, '97.
T. P. Elmore, '94.
L. H. Ely, '92.
L. O. Emmerich, '82.
T. G. Empie, '94.
G. W. Engel, '92.
*J. R. Engelbert, '85.
B. Enright, '93.
G. R. Enscoe, '96.
J. de la C. Escobar, '91.
H. B. Evans, '93.
W. A. Evans, '96.
T. M. Eynon, '81.

F

E. L. Faison, jr., '95.
G. H. Farman, '95.
*W. D. Farwell, '89.
E. F. Fassitt, '71.
F. Faust, '94.
M. H. Fehnel, '87.
J. DuB. Ferguson, '94.
C. V. Ferriday, '96.
E. C. Ferriday, '95.
R. Ferriday, '94.
W. Ferris, '95.
C. E. Fink, '90.
F. W. Fink, '86.
A. A. Finkh, '97.
*F. E. Fisher, '90.
F. R. Fisher, '90.
H. S. Fisher, '87.
C. B. Flory, '96.
R. D. Floyd, '94.
C. W. Focht, '88.
H. A. Foering, '90.
W. B. Foote, '84.
A. E. Forstall, '83.
W. Forstall, '91.
C. R. Fountain, '96.
J. J. Frank, '94.
G. S. Franklin, '88.
H. W. Frauenthal, '89.
A. H. Frazier, '89.
K. Frazier, '87.
*T. W. Frederick, '76.
S. W. Frescoln, '88.
F. Freyhold, '85.
E. R. Frisby, '98.
G. H. Frost, '93.
F. P. Fuller, '93.
W. B. Fuller, '98.
I. D. Fulmer, '97.

G

*G. L. Gabrio, '95.
L. L. Gadd, '94.
R. F. Gadd, '93.
A. G. Galan, '95.
J. M. G. Galan, '98.
F. M. Gallardo, '97.
T. J. Gannon, '96.
L. P. Gaston, '88.
W. Gates, jr., '88.
C. W. Gearhart, '93.
R. E. L. George, '98.
E. A. Giberga y Galé, '95.
J. J. Gibson, '95.
P. D. Giess, '77.
*J. E. Gilbert, '78.
J. B. Given, '96.
T. Gjertsen, '92.
F. W. Glading, '94.
A. M. Glassel, '77.
*J. B. Glover, jr., '88.
E. G. Godshalk, '95.

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* Deceased.

H. H. Godshall, '93.
N. O. Goldsmith, '83.
O. S. Good, '97.
R. Goodman, '90.
W. T. Goodnow, '83.
W. R. Goss, '95.
R. C. Gotwald, '86.
*J. S. Graff, '96.
M. B. Graff, '94.
S. L. Graham, '93.
F. L. Grammer, '89.
W. Gratz, '98.
C. W. Gray, '81.
G. E. Greene, '90.
W. Griffith, '76.
J. S. Griggs, jr., '91.
E. A. Grissinger, '94.
R. S. Griswold, '97.
L. J. H. Grossart, '86.
W. H. Groverman, '96.
*J. A. Gruver, '92.
F. H. Gunsolus, '98.
B. Guthrie, '94.

H

C. W. Haines, '74.
F. T. Haines, '95.
*H. S. Haines, '87.
J. F. Halbach, '75.
B. F. Haldeman, '81.
D. Hall, '96.
W. McC. Hall, '94.
F. D. Hallock, '94.
T. G. Hamilton, '95.
M. S. Hanauer, '86.
W. T. Hanly, '97.
H. Hardcastle, '88.
T. H. Hardcastle, '80.
W. G. Hare, '98.
H. W. Harley, '90.
H. T. Harper, '84.
G. W. Harris, '89.
L. S. Harris, '93.
G. A. Hart, '88.
W. D. Hartshorne, '74.
R. R. Harvey, '95.
S. J. Harwi, '86.
G. S. Hayes, '91.
C. S. Haynes, '93.
R. Hazel, '98.
S. C. Hazelton, '86.
W. C. Hazlett, '78.
R. W. Heard, '93.
D. G. Hearne, '90.
R. C. H. Heck, '93.
I. A. Heikes, '85.
J. S. Heilig, '91.
W. A. Heindle, '91.
G. M. Heller, '77.
L. Henderson, '89.
T. L. Henry, '95.
A. W. Henshaw, '94.
A. A. Herr, '74.
H. N. Herr, '96.
J. F. Hersh, '91.
H. B. Hershey, '98.
H. D. Hess, '96.
H. H. Hess, '98.
H. S. Hess, '95.
A. Y. Hesse, '94.
C. E. Hesse, '89.
H. V. Hesse, '91.
W. S. Hiester, '97.
I. M. Higbee, '95.
H. H. Hillegass, '84.
F. H. Hilliard, '94.

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* Deceased.

E. D. Hillman, '98.
W. J. Hiss, jr., '95.
J. B. Hittell, '87.
J. D. Hoffman, '83.
E. F. Hofford, '84.
W. E. Holcombe, '94.
J. S. B. Hollinshead, '90.
M. H. Holz, '94.
P. D. Honeyman, '91.
R. B. Honeyman, '88.
G. G. Hood, '83.
R. N. Hood, '97.
J. T. Hoover, '91.
C. C. Hopkins, '82.
W. Hopkins, '95.
G. L. Hoppes, '83.
H. J. Horn, '98.
L. S. Horner, '98.
H. S. Houskeeper, '72.
F. K. Houston, '90.
J. M. Howard, '87.
F. P. Howe, '78.
M. A. DeW. Howe, jr., '86.
R. P. Howell, '96.
A. A. Howitz, '94.
C. W. Hudson, '89.
G. W. Hunsicker, '94.
G. C. Hutchinson, '94.

I

H. Ichikawa, '91.
D. W. Irvine, '95.
H. T. Irwin, '97.

J

W. S. Jackson, '96.
C. B. Jacobs, '95.
E. A. Jacoby, '95.
H. S. Jacoby, '77.
W. L. Jacoby, '92.
W. A. James, '95.
J. A. Jardine, '84.
H. S. Jaudon, '95.
S. H. Jencks, '88.
G. A. Jenkins, '70.
A. P. Jenks, '97.
A. B. Jessup, '95.
A. E. Jessup, '92.
J. T. Jeter, '80.
J. J. Jimenez, '92.
E. B. John, '95.
H. S. Johnson, '97.
V. A. Johnson, '96.
A. Johnston, '89.
A. B. Jones, '94.
B. H. Jones, '94.
C. C. Jones, '87.
H. H. Jones, '97.
A. E. Juhler, '91.
C. A. Junken, '86.

K

A. S. Kappella, '95.
D. Kautz, '95.
W. H. Kavanaugh, '94.
W. B. Keim, '95.
C. L. Keller, '93.
J. S. Kellogg, jr., '89.
J. W. Kellogg, '84.
H. Kemmerling, '91.
J. M. S. Kerlin, '89.
D. G. Kerr, '84.
W. J. Kerr, '70.
H. E. Kiefer, '92.
W. F. Kiesel, jr., '87.
C. F. King, '80.

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* Deceased.

H. E. Kip, '95.
R. R. Kitchel, '92.
J. W. Kittrell, '87.
V. W. Kline, '96.
*L. E. Klotz, '72.
H. M. Knapp, '91.
F. N. Kneas, '98.
R. W. Knight, '94.
F. H. Knorr, '87.
S. B. Knox, '93.
B. G. Kodjbanoff, '98.
J. deB. Kops, '83.
J. B. Krause, '98.
R. E. Kresge, '96.
W. V. Kulp, '90.
H. M. Kurtz, '90.

L

S. W. Labrot, '92.
D. H. Lackey, '95.
N. Lafon, '78.
P. A. Lambert, '83.
S. E. Lambert, '89.
W. A. Lambert, '95.
O. M. Lance, '72.
H. K. Landis, '90.
C. A. Langdon, '94.
*S. D. Langdon, '87.
F. B. Langston, '84.
W. Langston, '84.
L. E. Lannan, '95.
G. L. de Lara, '86.
R. E. Laramy, '96.
W. A. Lathrop, '75.
F. C. Lauderburn, '91.
E. H. Lawall, '82.
J. P. S. Lawrance, '73.
T. H. Lawrence, '98.
J. W. Ledoux, '87.
L. R. Lee, '97.
H. Lefevre, '92.
H. D. Leopold, '94.
C. McK. Leoser, jr., '91.
T. S. Leoser, '90.
A. E. Lewis. jr., '88.
A. H. Lewis, '95.
G. Lewis, '95.
T. Lewis, '97.
J. J. Lincoln, '89.
G. B. Linderman, '87.
R. P. Linderman, '84.
J. B. Lindsey, jr., '98.
A. E. Lister, '92.
J. E. Litch, '90.
J. E. Little, '94.
C. V. Livingston, '97.
W. J. Lloyd, '92.
J. Lockett, '89.
B. W. Loeb, '95.
F. S. Loeb, '93.
A. Long, '89.
A. F. Loomis, '97.
B. E. Loomis, '96.
C. A. Loomis, '98.
J. T. Loomis, '92.
W. Lord, '96.
T. P. Lovering, '95.
C. A. Luckenbach, '86.
C. O. Luckenbach, '94.
W. A. Lydon, '86.

M

J. B. MacBride, '96.
C. S. MacCalla, '96.
W. H. MacCarthy, '71.
H. D. McCaskey, '93.

* Deceased.

H. H. McClintic, '88.
M. McClung, jr., '94.
J. A. McClurg, '91.
W. A. McFarland, '88.
C. W. Macfarlane, '76.
H. L. McIlvain, '88.
R. A. McKee, '95.
C. L. McKenzie, '93.
F. A. McKenzie, '95.
S. T. McKenzie, '95.
B. MacNutt, '97.
J. D. McPherson, '94.
J. S. Mack, 88.
R. W. Mahon, '76.
J. J. deG. Malcher, '76.
H. L. Manley, '92.
W. P. Marr, '93.
C. D. Marshall, '88.
L. H. Marshall, '98.
J. F. Marsteller, '77.
J. VanS. Martenis, '94.
J. J. Martin, '89.
J. G. Mason, '97.
N. P. Massey, '95.
R. S. Masson, '92.
V. E. Masson, '96.
J. O. Mathewson, '94.
A. S. Maurice, '93.
C. F. Maurice, '95.
G. H. Maurice, '93.
A. E. Meaker, '75.
W. A. Megraw, '97.
H. S. Meily, '87.
E. A. Mercenario, '97.
J. F. Merkle, '84.
F. A. Merrick, '91.
*W. S. Merrill, '94.
T. Merriman, '97.
T. Merritt, '74.
E. J. Millar, '92.
Charles Henry Miller, '88.
*Charles Henry Miller, '89.
Charles Herbert Miller, '90.
E. F. Miller, '83.
E. W. Miller, '96.
G. P. Miller, '88.
J. E. Miller, '93.
J. S. Miller, '95.
J. Z. Miller, '91.
W. H. Miller, '94.
*J. H. Millholland, '88.
P. D. Millholland, '86.
H. S. Miner, '88.
H. B. de Miranda, '73.
R. F. de Miranda, '72.
*S. Miyahara, '77.
C. W. Moffett, '89.
C. A. Moore, '94.
R. de la Mora, '96.
W. F. More, '83.
C. H. Morgan, '96.
*C. F. Moritz, '98.
A. D. Morris, '95.
H. T. Morris, '91.
R. H. Morris, jr., '89.
W. E. Morris, '89.
J. Morrison, '75.
H. S. Morrow, '88.
J. A. Morrow, '87.
J. T. Morrow, '89.
N. Morrow, '83.
R. T. Morrow, '82.
C. T. Mosman, '92.
D. L. Mott, '88.
F. D. Mount, '97.
W. S. Murray, '95.

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* Deceased.

W. H. Mussey, '96.
H. K. Myers, '84.
J. H. Myers, '96.
W. F. Mylander, '93.

N

C. P. Nachod, '97.
G. Nauman, jr., '90.
W. L. Neill, '88.
R. Neilson, jr., '95.
H. S. Neiman, '88.
J. L. Neufeld, '94.
C. W. F. Neuffer, '94.
R. E. Neumeyer, '90.
C. A. Newbaker, '94.
H. H. Newton, '97.
D. K. Nicholson, '85.
T. Nicholson, '83.
H. B. C. Nitze, '87.
R. C. Noerr, '97.
B. B. Nostrand, jr., '78.
A. R. Nuncio, '84.

O

J. A. de Obaldia, '98.
A. D. Oberly, '89.
F. Oberly, '96.
R. L. Ogden, '94.
J. F. O'Hearn, '94.
W. R. Okeson, '96.
C. L. Olmsted, '93.
L. A. Olney, '96.
R. B. Olney, '92.
J. M. O'Malley, '89.
C. J. O'Neill, '93.
G. Ordway, '94.
J. O'Reilly, '98.
H. Orth, jr., '92.
N. M. Osborne, jr., '93.
R. E. Ozias, '92.

P

J. W. Packard, '84.
*H. E. Packer, '70.
H. C. Paddock, '98.
*J. H. Paddock, '79.
P. M. Paine, '91.
*H. Palmer, '88.
H. L. Palmer, '96.
M. P. Paret, '78.
C. J. Parker, '88.
C. W. Parkhurst, '93.
D. W. Patterson, '93.
G. S. Patterson, '83.
W. A. Payne, '94.
R. R. Peale, '83.
H. R. Peck, '97.
J. G. Peck, '93.
F. S. Pecke, '75.
J. H. Pennington, '97.
W. C. Perkins, '90.
F. A. Perley, '98.
R. S. Perry, '88.
*F. B. Petersen, '85.
J. G. Petrikin, '96.
G. F. Pettinos, '87.
W. V. Pettit, '94.
J. H. Philips, '95.
A. E. Phillips, '90.
J. Phillips, jr., '95.
R. H. Phillips, '87.
F. W. B. Pile, '88.
C. Platt, '90.
J. S. Polhemus, '72.
R. K. Polk, '87.
C. P. Pollak, '87.

*Deceased.

M. W. Pool, '96.
H. F. J. Porter, '78.
R. H. E. Porter, '89.
H. A. Porterfield, '83.
A. Potter, '90.
G. E. Potter, '80.
S. C. Potts, '94.
J. L. Poultney, '95.
E. W. Pratt, '90.
M. D. Pratt, '87.
H. R. Price, '70.
J. B. Price, '85.
E. J. Prindle, '90.
F. H. Purnell, '83.
M. H. Putnam, '97.

Q

C. W. Quarrier, '98.
E. A. Quier, '91.
H. C. Quigley, '95.

R

F. DeW. Randolph, '92.
R. B. F. Randolph, '93.
W. K. Randolph, '78.
J. L. Rankin, '96.
R. S. Rathbun, '92.
A. G. Rau, '88.
C. R. Rauch, '77.
C. E. Raynor, '88.
R. H. Read, '78.
V. C. Records, '98.
H. B. Reed, '70.
H. P. Reed, '96.
P. L. Reed, '98.
W. M. Rees, '74.
A. K. Reese, '89.
A. S. Reeves, '84.
H. A. Reid, '96.
J. G. Reid, '93.
W. Reinecke, jr., '95.
E. T. Reisler, '87.
H. G. Reist, '86.
W. F. Rench, '91.
J. W. Reno, '83.
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*W. D. Ronaldson, '70.
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*A. S. Ross, '86.

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E. P. Roundey, '97.
H. W. Rowley, '85.
W. Royce, '97.
*G. A. Ruddle, '86.
J. Ruddle, '83.
J. D. Ruff, '82.
G. H. Ruggles, '96.
C. B. Rutter, '94.
C. C. Rutter, '96.

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J. E. Sanborn, '90.
R. F. Sanchez, '98.
C. F. Sanders, '97.
F. W. Sargent, '79.
W. R. Sattler, '88.
*M. L. Saulsbury, '93.
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E. A. Schnabel, '91.
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*J. W. Scull, '87.
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C. K. Shelby, '92.
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*A. Y. Shepherd, '96.
G. E. Shepherd, '94.
D. F. B. Shepp, '98.
J. L. Sheppard, jr., '97.
H. J. Sherman, '90.
J. E. Shero, '95.
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*E. O. Smith, '85.
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P. H. W. Smith, '92.
R. E. Smith, '94.

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* Deceased.

B. R. Smoot, '98.
A. M. Smyth, '89.
E. E. Snyder, '87.
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E. A. Soleliac, '93.
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J. H. Spengler, '86.
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H. T. Stilson, '91.
W. R. Stinemetz, '93.
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*R. Stinson, '83.
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*J. K. Surls, '86.
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E. H. Symington, '98.
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H. Toulmin, '86.
P. Toulmin, '86.
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J. B. Townsend, '95.
C. E. Trafton, '96.
L. B. Treharne, '80.
W. Treichler, '97.
H. C. Tripp, '96.
P. H. Trout, '94.
L. E. Troutman, '93.
O. W. Trueworthy, '94.
R. H. Tucker, '79.

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* Deceased.

Charles P. Turner, ’89.
Clarence P. Turner, ’94.
Claude A. P. Turner, ’90.

U

C. W. Underwood, ’94.
W. E. Underwood, ’97.
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M. N. Usina, ’92.

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E. Vander Horst, ’89.
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F. Wittman, '92.
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*F. C. Wooten, '80.
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The Register is sent to all graduates who furnish their addresses for the purpose, and to all other persons on application to

THE SECRETARY OF THE LEHIGH UNIVERSITY,
South Bethlehem, Pa.